EAST BROAD TOP RAILROAD & COAL COMPANY Pennsylvania State Rt. 994
West of Rt. 522
Rockhill Furnace
Huntingdon County
Pennsylvania

HAER No. PA-127

HAER PA 31-ROCFN,

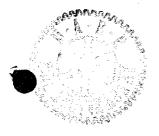
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HISTORIC AMERICAN ENGINEERING RECORD

HAER PA 31-ROCFN

EAST BROAD TOP RAILROAD & COAL COMPANY (EBT)

(Rockhill Iron & Coal Company)

HAER No. PA-127

Location:

Rockhill Furnace, Huntingdon

County, Pennsylvania Quad: Orbisonia

UTM:

18:253.275:4.458.250

Date of Construction:

Ca. 1872

Fabricator:

Unknown

Present Owner:

Kovalchick Scrap Company, Indiana,

Pennsylvania

Present Use:

Tourist attraction

Significance:

One of the last narrow-gauge steam railroads in the United States, the

EBT shop complex at Rockhill

Furnace contains an intact machine shop, blacksmith shop, foundry, turntable and roundhouse, as well as depot and ancillary buildings.

Project Information:

In February, 1987, the Historic American Engineering Record (HAER) and the Historic American Buildings Survey (HABS) began a multi-year historical and architectural

documentation project in

southwestern Pennsylvania. Carried out in conjunction with America's Industrial Heritage Project (AIHP), HAER undertook a comprehensive inventory of Westmoreland County to identify the region's surviving

identify the region's surviving historic engineering works and industrial resources. HAER began its documentation of the East Broad

Top shop complex in 1989, and continued documentation in 1994.

Historian:

Matthew Kierstead

INTRODUCTION

Between 1874 and 1956, the three-foot, narrow-gauge East Broad Top Railroad hauled the agricultural, forest and mineral products of Huntingdon County, Pennsylvania's "Lower End" from Broad Top Mountain to a transfer connection with the standard-gauge Pennsylvania Railroad at Mount Union. The story of the EBT, as it is popularly called, is linked to the geology of the region and the relationship between regional minerals and changing industrial markets and technologies.

The East Broad Top was originally chartered on April 16, 1856 to transport coal from the Broad Top Mountain coal field. Activation of the charter in 1871 was linked to the revival of the Juniata Valley iron industry and the need to assemble local coking coal, iron ore and limestone flux at the new blast furnaces of the Rockhill Iron and Coal Company at Rockhill Furnace and to provide an outlet for the pig iron produced there until 1908. In the early twentieth century, changing steelmaking technology made formerly useless quartzite found along the EBT a valuable material for the manufacture of refractory brick for metallurgical furnaces; eventually, it became the railroad's primary freight, in addition to limestone, slag, and brick clay. The railroad was ultimately at the mercy of changing demands for minerals, and was always particularly vulnerable to its primary reliance on coal.

The EBT was one of the first narrow-gauge railroads in America, and one of the last operating at the time of its abandonment. Constructed at the start of a narrow-gauge movement that briefly influenced American railroading during the 1870s and 1880s, its proponents believed the narrow-gauge held construction and operating advantages.

The EBT successfully overcame the two greatest challenges to narrow-gauge railroads: maximizing ton-miles per trip and the efficient transfer of cargo at the terminus with a standard-gauge railroad. The railroad built heavy-duty track and utilized large steam locomotives. At its shop complex the EBT constructed a unique fleet of coal cars to increase tonnage and developed various devices to haul broad-gauge cars over the narrow-gauge line in order to streamline freight transfer. The flow of raw materials was configured so as to eliminate transfer, and dual-gauge trackage was used in serving industries at the interchange with the Pennsylvania Railroad at Mount Union. The East Broad Top was the ultimate expression of American narrow-gauge railroading-a road with a narrow-track-gauge, that strove to build, haul and interchange like a broad-gauge railroad.

GEOLOGICAL CONTEXT

The East Broad Top Railroad owes its name to a prominent geographical feature, Broad Top Mountain, and its existence to the wealth of industrial minerals there and in the immediate vicinity. Structurally, the rock layers in the ridge-and-valley province of the Appalachian Mountains where the Broad Top is located are composed of a series of alternating downfolded synclines and their upfolded counterparts, anticlines. These features follow the northeast to southwest orientation of the Appalachian Trend. Generally, folds are closely spaced, usually a mile to a few miles apart, and the series of sharp ridges and narrow valleys that result give the Appalachians their characteristic corrugated appearance. The Broad Top Mountain, as its name suggests, is different from other Appalachian mountains. Broad Top Mountain is the northern end of a larger regional geological feature called the Broad Top Synclinorium, which stretches south to the Clifton Forge, West Virginia area. A synclinorium is a deep, regionally downfolded trough in the rock strata. The Broad Top Synclinorium follows the general Appalachian trend, and resembles an attenuated upside-down teardrop. Broad Top Mountain or, simply, the Broad Top, is bounded by Sideling Hill to the east, and Terrace Mountain to the west and comprises the wide rolling plateau at the northern end of the synclinorium, approximately twenty-five miles in width and draining into the watershed of the Juniata River.1

The form of the Broad Top, and the deposition of the minerals in this landform relevant to this story of the EBT, are ultimately linked to the cyclical movements of the tectonic plates. The present form of the Appalachians, and the origin and nature of their rocks, can be traced back to Precambrian time, approximately 630 million years ago, when the North American tectonic plate began to move apart from Africa and South America. At that time, North America rifted, or split, roughly along what is now the Appalachian Trend. This area of hot, broken crust became dormant and filled with deep sediment, resembling a large inland seaway, much like modern-day Chesapeake Bay, subject to fluctuating water levels and accumulating sediments.

Approximately 440 million years ago, the first of three collisions between tectonic plates and accompanying orogenic, or

¹This general description of the Broad Top, and the following discussion of the historical geography of the same, are based on an interview with Dr. Terry Engelder, Geologist, Department of Geosciences, Pennsylvania State University, State College, Pa. on July 7, 1994, unless otherwise indicated.

mountain-building events took place. This event, called the Taconic Orogeny, resulted when the North American plate collided with an island arc, an event that uplifted the land to the east of the present Appalachians. The erosion and westward transport of material from the upthrust land created a thick sedimentary deposit, called a clastic wedge. One formation in this group of sediments is the Tuscarora quartzite, a resistant mountain building rock which forms many of the high ridges in the present Appalachians. The source of the transported sediment was thought to have been a marine environment, for the Tuscarora quartzite is derived from beach sands. Also called ganister, it was later one of the three most important commodities hauled by the EBT, as it was becoming an important raw material for the refractory brick industry in Mount Union and elsewhere in the region.

Iron ore was also important to the existence of the EBT. During the Silurian, about 420 million years ago, bands of sedimentary iron ore deposits formed in shallow bays and lagoons where iron transported by fresh water came into contact with seawater, and formed replacement deposits of hematite iron ore in rocks rich in calcium carbonate. This process formed the Clinton iron ore formation, which stretches from New England to Alabama. Similar processes during the Devonian also led to the formation of the Marcellus hematite. Deposits of both ore types were eventually mined to feed the furnaces of the Rockhill Iron and Coal Co.

After the Taconic Orogeny, there was a period of relative tectonic inactivity. This was disrupted in the late Devonian, about 350 million years ago, when North America collided with another plate. The Acadian Orogeny that ensued filled the land of the present Appalachians with additional sediments. This event also marks the beginning of the Carboniferous period. At that time, the area in question was located in an equatorial environment, much like today's Amazon River basin, only even more lush. During the Pennsylvanian period, dozens of periodic adjustments of the elevation of land took place, and thick mats

²Moore, E.S and T.G. Taylor, <u>The Silica Refractories of Pennsylvania</u> Pa. Geol. Surv. Bull.M3, 1924, p.19

³Similar sands were deposited in the Devonian as well. The Oriskany sandstone deposits in Mapleton and McVeytown were pure enough for use in the glass industry.

⁴Laurence, Robert A. "Ore Deposits of the Southern Appalachians," in <u>Ore Deposits of the United States 1933-1967</u>. AIME, New York, 1968. p.158.

of peat and drowned vegetation were covered by sands and muds. These were eventually buried and subjected to heat and pressure at depth, metamorphosing them into a high fixed carbon fuel—coal—that became the EBT's lifeblood. Approximately forty million years later, the Alleghennian Orogeny a major continental collision deposited another wedge of sediments on the area that became the present Appalachians. The continental collision was so powerful, however, that it folded the eastern half of the accumulated sedimentary rocks like a stack of carpets, upthrusting the Appalachian Mountains. Erosion eventually wore the high, young Appalachian Mountains down to their roots, exposing the complex, often steeply dipping and heavily folded stratigraphy visible today.

For reasons still debated by geologists, the tight folding so characteristic of the Appalachians as a whole did not affect the area now known as the Broad Top Synclinorium. Instead of tightly folding the strata, thus subjecting the youngest rocks, including the coal measures, to deep erosion, tectonic forces thrust the rocks of the Broad Top into a deep, broad bowl, preserving the Pennsylvanian coal deposits. In addition to the coal of the Broad Top, the local iron ores, and the pure quartzite in the EBT's domain, quality fluxing limestone and refractory clays were also deposited in the region. These industrial mineral deposits were emplaced through the processes described, and through erosion, slowly revealed for later discovery by pioneers and entrepreneurs.

EARLY JUNIATA VALLEY IRON INDUSTRY -- EARLY REGIONAL TRANSPORTATION

The first economic utilization of the mineral resources of the Juniata Valley region was the charcoal-fired blast furnace pig iron industry. The first blast furnace in the Juniata Valley, the Bedford Furnace on Blacklog Creek at Orbisonia, was constructed in 1785 by George Ashman, Edward Ridgely, and Thomas Cromwell, at a site with a workable combination of iron ore banks, charcoal timber, fluxing limestone, and water power. A forge was also constructed in 1791, and the ten ton-per-week output of the furnace was shipped by boat and horse to market in

⁵The chronology of geological events was reconstructed from Slingerland, Rudy, et al, <u>Intercollegiate Geological Conference Field Trip Guide T152: Sedimentology and Thermal-Mechanical History of Basins in the Central Appalachian Orogen</u>. n.d., Geosciences Department, Pennsylvania State College, State College, Pa.

Philadelphia, Baltimore, and Pittsburgh. Orbisonia is significant as the later location of the furnaces of the Rockhill Iron and Coal Company, and the shops of the East Broad Top Railroad.

During the first half of the eighteenth century, the Juniata charcoal iron industry, which included Huntingdon, Blair, Mifflin, and Center counties, expanded greatly. In 1850, at its peak, the Juniata iron district boasted forty-eight blast furnaces, forty-two forges, and eight rolling mills. According to noted nineteenth century metallurgist and inventor Eli Whitney, Juniata charcoal iron was "some of the best in the world." During the 1830s, several other blast furnaces were constructed in the Orbisonia area. These furnaces included the Rockhill (1830), the Winchester (1832), and the Chester (1837). By 1860, however, all of these furnaces were out of blast, and the Juniata iron industry was in decline. The reasons for this decline included reduced availability of raw materials, market and technological competition from outside the region, and poor transportation.

The Juniata furnaces relied entirely on local raw materials for their charge. The Orbisonia furnaces obtained their ore from two local formations, the Blacklog "fossil" hematite, a Silurian

⁶Swank, James M. <u>History of the Manufacture of Iron in All Ages</u>. Phila: author, 1884, p.156. According to Africa, the surplus iron from this furnace was taken to Pittsburgh, and he states that it was thus the first bar iron made in the U.S. to be shipped to the Pittsburgh market. (Africa, p.54); Erroneously described as first furnace west of the Susquehanna, a qualification which appears to start with J. Simpson Africa's <u>History of Huntingdon and Blair Counties</u>, <u>Pennsylvania</u> (Phila: Louis H. Everts, 1883, p. 54).

⁷Swank, p.162.

^{*}Letter from Eli Whitney, 12 June, 1819, quoted in Albert M. Rung, Rung's Chronicles of Pennsylvania History, Huntingdon: Hutingdon County Historical Society, 1977, p.275. Reference in Shedd, Nancy Huntingdon County, Pennsylvania--An Inventory of Historic Engineering and Industrial Sites. HABS/HAER--AIHP, Washington, D.C: 1991.

⁹A Detailed Statement of all of the Hot Blast Charcoal Furnaces in Eastern Pennsylvania in the year 1850. photocopies of unidentified statistical charts, Huntingdon County Historical Society, Huntingdon, Pa. Personal files of Nancy Shedd.

Clinton Formation ore that outcropped in Blacklog Narrows, less than a mile from Orbisonia, and the Marcellus hematite, a Devonian ore found to the west of Orbisonia, near Three Springs. The iron ore outcrops follow the stratigraphy, and therefore take the form of complex ovals and zig-zags, with thin and steeply dipping beds. The ores were separated into two varieties, soft limonite ore, which was a weathered surface accumulation of the second type, an underlying hard hematite ore. Soft ore was mined first, as it was easier to obtain. When it was exhausted, as much of it had been by 1850, drift mines were opened on the narrow hard ore hematite veins, a more expensive type of mining operation that required drilling and blasting. To further complicate matters, the inexpensive weathered ore assayed as high as fifty per cent iron or higher, whereas the more expensive ore often contained less than twenty-five per cent iron. The second strain of the second strain of

The fuel for the furnaces was charcoal, which was obtained from the controlled destructive distillation of cut hardwoods in large earth-covered mounds. Many acres of timber were required to smelt a few tons of iron, and by 1850 the iron concerns had depleted their stands of charcoal timber. Flux for the furnaces was quarried from limestone beds located in Blacklog Valley. 12

In addition to shortages of raw materials, the Juniata furnaces were in competition for market outlets. This was due both to the favorable tariff policies of President Polk for imported iron at eastern seaboard ports, and the ascendancy of Pittsburgh as a center of iron manufacture in the west. Iron making technologies such as the use of anthracite and coke fuel and high temperature air blasts was increasing the efficiency and

¹⁰ Dewees, John H. Report of Progress in the Juniata District on the Fossil Iron Ore Beds of Middle Pennsylvania, with a Report of the Aughwick Valley and The East Broad Top District. by Charles A. Ashburner. Harrisburg: Geol. Surv. of Pa. 1878. p.f.xi.

¹¹Hickock, William O. <u>Iron Ores of Pennsylvania</u>. Harrisburg, Topo. & Geo. Surv. 1939. p.2

¹² Miller, Benjamin Leroy. <u>Limestones of Pennsylvania</u>. Harrisburg: Pa. Geol. Surv. 4th Series Bulletin M-7, 1925. p.162: At the Grove Quarry, one and one-half miles from Orbisonia, "There is some fair fluxing stone that was formerly used in the Orbisonia furnace."

¹³Binder, Frederick Moore. <u>Coal Age Empire: Pennsylvania Coal</u> and its <u>Utilization to 1860</u>. Commission of Pennsylvania History and Museum Commission, Harrisburg: 1974, p.81.

output of furnaces elsewhere, and the economies of vertical integration were also becoming manifest.

Becoming increasingly isolated, a major problem facing the iron manufacturers of the Juniata region was the need for timely and inexpensive transportation of finished goods to market. The first shipments of iron from the valley were eight-foot bars bent over the backs of horses. Water transportation via the Juniata River used arks during times of high water. In the early 1820s, advocates of a Susquehanna-Ohio river connection supported a canal along the course of the Juniata River. In 1834 the Canal was completed between Philadelphia and Pittsburgh. This public work provided better transportation to eastern and western markets, but operated seasonally, and was prone to flood damage. The Pennsylvania Canal was not enough to counteract the factors affecting the declining Juniata iron industry, which would experience a revival due in part to the coming of an even newer mode of transportation, the railroad.

JUNIATA IRON INDUSTRY REVIVAL

About 1850 several circumstances contributed to the revival of the Juniata iron industry and the emergence of the Broad Top coal mining and railroad concerns. The most critical event was the coming of the Pennsylvania Railroad, incorporated April 13, 1846. The road was planned to connect Philadelphia with Pittsburgh, and followed of the earlier Pennsylvania Canal for a portion of its route, which brought the tracks within eleven miles of Orbisonia. The first train from Philadelphia to Huntingdon ran on June 7, 1850, and the first train to Pittsburgh, via the old canal boat incline at Hollidaysburg ran on December 10, 1852. The Mountain Division, which bypassed the incline, was completed on February 15, 1854, and through rail service to Pittsburgh began. 16

In the Juniata region, as elsewhere, the coming of the Pennsylvania Railroad spawned a flurry of railroad ventures, most of which were of a speculative nature. The manufacturers of the southern half of Huntingdon County, referred to as the "Lower

¹⁴Jordan, p.282.

¹⁵National Historical Association, Inc. <u>A History of the Juniata Valley in Three Volumes</u>. Harrisburg: Vol.1, 1936, p.51-54.

¹⁶Africa, p37.

¹⁷Rainey, passim.

End", anticipated the improved transportation that the Pennsylvania Railroad would bring for their tanneries, lumber mills, iron furnaces, and agricultural concerns, but it was the awakening interest in the coal resources of Broad Top Mountain that spurred the actual construction of the two viable railroads that served the Broad Top, the Huntingdon and Broad Top Mountain Railroad, and The East Broad Top Railroad.

The Broad Top coal field is an isolated eighty square-mile coal field located in the uneroded Pennsylvanian rocks at the northern end of the Broad Top Synclinorium. The Broad Top coals are considered to be an outlier of the Allegheny coal measures of southwestern Pennsylvania, as the seams of both fields can be correlated. The rocks of the Broad Top Synclinorium continue through the northeastern Pennsylvania anthracite belts, and are correlated with those coal seams. Ultimately, the Broad Top coal was found to have qualities of bituminous coals—its blocky fracture, low volatile content, and excellent steam and coking qualities, and also qualities of anthracite—hardness and luster, low sulfur content, and general mining characteristics. These hybrid characteristics are the result of the mild metamorphism of the bituminous Broad Top coals during the Allegheny Orogeny, that escaped the coal measures to the west, but produced the more dramatically altered anthracites to the northeast.

The first use of Broad Top coal has been credited to exiled Revolutionary War Tories. 20 Other eighteenth century use was limited with a mine belonging to an Amos Figard noted by Henry Darwin Rogers, and numerous accounts of Broad Top coal being used to great success by area blacksmiths. 21 In 1820, Samuel Riddle opened a coal bank at Allen Port, from which he unsuccessfully attempted to market crushed coal as an agricultural fertilizer.

¹⁸Ashley, George H. <u>Bituminous Coal Seams of Pennsylvania</u>. Part 1, <u>General Information on Coal Harrisburg: Pennsylvania Geological Survery 1928</u>, p.129.

¹⁹ Daddow, Samuel Harries and Benjamin Bannan. Coal, Iron, and Oil; or, the Practical American Miner. A Plain and Popular Work on Our Mines and Mineral Resources, and a Text-Book or Guide to Their Economical Development. Benjamin Bannan, Pottsville, Pa., 1866. p.298-301.

²⁰Gardner, p.16

²¹Gardner, p.16. According to Daddow, p.302, The Broad Top coal had in 1866 "long been known as the best for blacksmithing purposes."

The first generally recognized mine on the East Side of the Broad Top was the Houck Mine, opened in 1830. Only half a dozen mines were opened on the Broad Top during the first half of the nineteenth century, and the coal was used for local forges, smithing, and heating purposes. Transportation of coal was similar to that used by the iron industry: horses, sleds, and river boats.

Serious commercial volume shipments of Broad Top coal did not begin until the completion of the Huntingdon and Broad Top Mountain Railroad, the first railroad to tap Broad Top mines and connect them with the Pennsylvania Railroad. The H&BTMRR was incorporated May 6, 1852, and the first coal was interchanged with the Pennsylvania Railroad in February of 1856. Due to its location and particular qualities, Broad Top coal found ready markets in eastern cites such as Baltimore and Philadelphia for use in locomotive, marine, and urban stationary industrial or residential boilers, or ovens and kilns where a hot and clean burning coal was needed. Broad Top coal was also important to metallurgical industries, where it was used for rolling mill soaking pits, puddling furnaces, and blacksmith forges. Shipments of Broad Top coal grew rapidly. By 1861, only five years after Broad Top coal became commercially available, over 250,000 tons per year were shipped to the eastern seaboard.

An important early market for Broad Top coal resulted from experiments performed by the Pennsylvania Railroad to find an alternative source of fuel for their locomotives which, like the iron furnaces, consumed vast quantities of wood. In 1857, just after the Broad Top mines began to produce, the Pennsylvania Railroad began to test various coals. It found Pittsburgh bituminous and Broad Top semi-bituminous coals to be excellent steam coals, influencing transition from wood to coal on the Pennsy and strengthening the reputation of Broad Top coal as a high-quality steam coal.²⁵

Broad Top coal's excellent coking qualities played an important role in the revitalization of the Juniata iron industry. Certain bituminous coals, when burned in a controlled, oxygen-starved environment, produce a strong, blocky, silvery,

²²Africa, p.38.

²³Daddow, p.302.

²⁴Binder, p.161.

²⁵Binder, 128-129

high fixed-carbon, low-sulfur fuel that is superior to charcoal for use in the iron blast furnace, and less expensive to produce. The first use of coked Broad Top coal is attributed to ironmaker William Firmstone, who used the fuel on an experimental basis at the Savage Iron Works for one month in 1835. In 1846, coal from the Kelly seam was coked in open pits at the Hopewell Furnace, and used for reheating iron for a rolling mill. From 1850 on, coke gained ascendancy as a blast furnace fuel in American ironworks, and the production of the fuel in open earth-covered pits changed to a process using various types of brick enclosures. In 1865, John Fulton, Mining and Civil Engineer, speaking about Broad Top Coke, declared:

When it is considered that the Broad Top coke has been found on trial to be a superior fuel for smelting [iron] ores, it is singular that this extensive source of mineral wealth should have so long escaped the eagle eye of capital in a region possessing railroad facilities and abounding with all the elements required for its successful manufacture.²⁸

BIRTH OF THE EBT

As John Fulton suggested, capitalists in the 1860s were indeed planning a new wave of development of the Broad Top's resources and the revitalization of the Juniata iron industry. In the early 1860s, Philadelphia businessmen Algernon and Edward Roberts visited the Huntingdon and Broad Top Mountain Railroad's Mountain House resort, a hunting and recreation destination for wealthy easterners interested in the new coal deposits in the area. Allegedly while hunting on the east side of the mountain, the Robertses located the old Houck Mine opening, and other favorable outcrops of coal, and began to purchase coal property there in 1862.²⁹

Transportation for the new coal resources on the east side of the Broad Top was obviously a concern, and there was some clamor for construction of a railroad. On February 28, a meeting was held in Scottsville and on March 24, 1849, the Drakes Ferry

²⁶Binder, p.79.

²⁷Gardner, p.70.

²⁸John Fulton, in Darrow, Samuel Harries and Benjamin Bannan. <u>Coal, Iron, and Oil; or, the Practical Miner.</u> Pottsville, Pa. Benjamin Bannan. 1866. p.19.

²⁹Morgan and Baughman, Heimburger, p.22-25, 74.

(Mount Union) and East Broad Top Railroad was chartered. Local industrialists also applied for a charter for another railroad, the East Broad Top Railroad and Coal Company, on April 16, 1856. Due to a lack of funds, neither of these roads were immediately developed.³⁰

The origin of the EBT, and its corporate parent, the Rockhill Iron and Coal Company, can be found in the old furnace companies of the Blacklog Narrows in Orbisonia. Orbisonia charcoal furnaces were not operated consistently, and changed hands a number of times before their demise. The creation of the RICCo. began in 1867-1868, when Dr. Lewis P. Royer and Percival P. Dewees purchased the holdings of the Rockhill and Winchester furnaces. Dewees had previous involvement in the Paradise Furnace, and his brother John H. Dewees was a geologist whose research included work on the Juniata iron ores. Royer and Dewees purchased 8,000 acres of iron ore and limestone lands on Blacklog and Shade mountains and in the Aughwick Valley, and 11,000 acres of coal and timber lands on the Broad Top. 32

But Dewees lacked the capital to transport coking coal from the Broad Top to his planned furnace complex in Orbisonia. He joined the Roberts group in a joint mining, railroad, coke oven, and iron furnace venture. Dewees sold half of his interest in his iron ore and coal land holdings to the Robertses, and on July 3, 1871 the old East Broad Top Railroad charter was reactivated. Numerous routes were surveyed for the new road, and a route from Mount Union, on the Pennsylvania Railroad and Canal, to Orbisonia was chosen, and the three-foot track gauge selected. This first leg of the railroad was begun September 16, 1872, and completed August 30, 1873. In March 1872, the corporate management of the EBT incorporated the Rockhill Iron and Coal Company, completing the corporate structure of the new integrated company.³³

From the outset, the Dewees-Roberts venture was designed as a vertically integrated concern, and work progressed on all fronts. Construction of two blast furnaces near Orbisonia began in 1873, and the railroad was extended a short distance into Blacklog Gap to tap ore veins and a fluxing limestone quarry.

³⁰Jordan, 287.

³¹Dates vary from source to source. For Rockhill, see Dewees, p.125; for Winchester, see Lyttle, p.304.

³²Lyttle, p.306.

³³Rainey, p.27, 37.

When the East Broad Top Railroad reached the new RICCo. mining town of Robertsdale on November 4, 1874, development of several mine openings had already begun. In 1875, a battery of coke ovens was built, and the first cast of Rockhill Furnace iron was made on January 3, 1876.³⁴

Technologically, the twin Rockhill Furnaces were of the transitional type, which developed from the simple stone stack furnaces typical of the first Juniata iron industry. Constructed by the Philadelphia firm Taws & Hartman, each furnace had a sixty-five foot tall iron-sheathed brick-lined stack with a seventeen foot diameter bosh. Hot blast was provided by two upright low-pressure Henry G. Morris blowing engines that forced air through four brick hot stoves with U-pipes and into the five tuyeres on each furnace. The furnace complex was an impressive building, E-shaped in plan, with 40 x 50 foot cast sheds and blowing engine house, and a 280 x 60 foot raw materials stock house. The furnaces were charged from the top, with raw materials raised by external elevator hoists. The Rockhill furnaces produced forty to fifty tons of iron per day, or 18,000 tons per year.

The furnace was charged with a mixture of 25% Marcellus hematite and 75% Blacklog "fossil" type hematite ores. The company opened up four drifts on an "inexhaustible" vein of fossil hematite on Blacklog Mountain at Blacklog Gap, as well as hematite mines on Sandy Ridge near Three Springs that yielded ore assaying up to 51% iron. The Grove Quarry east of Blacklog Gap was opened as a source of flux for the furnaces.

By 1874, the RICCo. had opened Rockhill Mines 1 and 2 in the Fulton Seam, and Nos. 3 and 4 in the Barnett seam. The Broad Top coal measures contained seven beds, with a total of twenty four feet of coal. Only three of these beds, however, the Barnett, Fulton, and the Kelly contained coal of an economically recoverable nature. In 1876, John M. Fulton, Cambria Iron Co. Mining Engineer, observed that "the eastern, or Broad Top field...affords two seams known locally as the Barnett and the Kelly, both good for the production of a bright, open, tenacious

³⁴Rainey, p.37-39.

³⁵ Dewees, p.126.

³⁶Dewees, p.127.

³⁷Lyttle, p.306-307.

and strong coke."³⁸ In 1875, the RICCo. constructed 68 "Belgian" type rectangular brick coke ovens. According to an 1876 Pennsylvania Geological Survey report, these ovens were known to produce an objectionable porous, high-sulfur fuel.³⁹ In 1887, the Belgian ovens were replaced by 100 of the more common "beehive" type.

John Fulton, writing in 1876, foresaw that "the charcoal era must pass...coke is destined to become the leading fuel for blast furnaces, and retain this position from its almost inexhaustible source of supply, its caloric efficiency, and its continued economy." The use of coke as a fuel certainly spurred the revitalization of the Juniata iron industry. In 1868, the Kemble Iron and Coal Company erected the first transitional, coke-fired furnaces in the Broad Top, followed by the RICCo. in 1876. By 1879, there were two coke-fired furnaces at Saxton, and in 1882, the Everett Iron Company was using coke produced at Minersville. These facilities were joined by the Colonial Iron Works, which made coke for its furnaces at Riddlesburg.

None of the three workable coal beds were especially thick, ranging from 5'6" to 3 feet, and all possessed a significant "parting", or slaty bed within the seam. In some places this parting was only a couple of inches thick, but it swelled up to fourteen feet thick in others. The presence of this slaty waste, or bone, in the run-of-mine coal necessitated the operation of coal washers to separate the useless material from the coal. Coal washing was initiated with the commencement of mining. In an 1872 account of early activity at Robertsdale, it was said "..they have a coal washer there, crusher, coke pits, and store." Coke was being made mineside in pits, prior to the construction of coke ovens. In Fulton's 1876 account of operations at Robertsdale, he refers to a "Bradford breaker," and an "English sluice washer." Fulton noted that "By this washing operation, many

³⁸Platt, Franklin, <u>Special Report on Coke Manufacture of the Youghiogheny River Valley</u>. Harrisburg: Pa geol surv 1876, p.120.

³⁹Fulton, p.130-131.

⁴⁰Fulton, p.177.

⁴¹Morgan and Boughman, "The History of the Broad Top Coal Field Situated in Huntingdon, Bedford, and Fulton Counties, Pa. n.d. (pamphlet).

 $^{^{42}}$ Lyttle, p.308.

coals can be made into good coke which otherwise could not prove satisfactory."43

In 1876, the RICCo. and the EBT possessed all of the basic components of a fully vertically integrated iron company--coal, ore, and limestone mines, coke ovens, blast furnaces, and rail transportation.

THE ROCKHILL IRON AND COAL COMPANY AND THE EBT, 1875-1908

The East Broad Top was run and equipped like a typical narrow-gauge railroad during its nineteenth century history, and little of direct technological significance regarding the challenges of the narrow-gauge was implemented on the railroad during those years. The corporate and operational history of the EBT has been told at length elsewhere. However, a brief account of notable events for the RICCo. and EBT during this period is appropriate.

The operations of the EBT Railroad in its early years were naturally dominated by iron production activities. Ore, coal, coke, and pig iron movements were all made by rail, and the company mines enjoyed a large captive market in the Rockhill coke ovens, in addition to coal shipped to eastern markets via Mount Union. The early years of operation for the RICCo. and its subsidiaries were not without problems, however, and the Company experienced financial problems due to coal mining difficulties, strikes, and depressions in the coal and iron markets.⁴⁴

⁴³Fulton, p.122.

⁴⁴ Although several prior references have been made to Lee Rainey and Frank Kyper's East Broad Top, it is appropriate at this point to note the significance and contribution of this important volume. East Broad Top is the only scholarly, book-length treatment of the Railroad, and should be the starting point for any serious research on the subject. Although the text was not published with references, the exhaustive bibliography certainly reflects the vast amount of research that went into the book, which is generally considered the primary reference by aficionados of the EBT. Since no other comprehensive source exists for the direct chronological history of the operational period of the EBT, the following sections on its operational history rely greatly on East Broad Top, and will be credited as such unless otherwise noted. Since the EBT story has been better told by Rainey, emphasis will be placed on technological matters, particularly those surrounding narrow-gauge operation.

The very geological forces that metamorphosed Broad Top coal into a unique and valuable fuel left it so physically convoluted that the high cost of mining it was offset only by the premium price the coal commanded. Within the general synclinal structure of the Broad Top basin, the coal-bearing strata is formed into waves and lesser synclines. Geologist Israel Charles White, in the Second Geological Survey of Pennsylvania, 1885, noted swells and rolls in the Barnett Bed, and the "great irregularities which are found in every extensive mine on the Broad Top, viz. the local thinning and thickening of the slate parting. Geological Survey of Pennsylvania, 1885, noted swells and rolls in the Barnett Bed, and the "great irregularities which are found in every extensive mine on the Broad Top, viz. the local thinning and thickening of the slate parting. Geological Survey of Pennsylvania, 1885, noted swells and rolls in the Barnett Bed, and the "great irregularities which are found in every extensive mine on the Broad Top, viz. the local thinning and thickening of the slate parting. Geological Survey of Pennsylvania, 1885, noted swells and rolls in the Barnett Bed, and the "great irregularities which are found in every extensive mine on the Broad Top, viz. the local thinning and thickening of the slate parting. Geological Survey of Pennsylvania, 1885, noted swells and rolls in the Barnett Bed, and the "great irregularities which are found in every extensive mine on the Broad Top viz.

The physical condition of the coal prevented the widespread adoption of the mining machines that were boosting production and cutting costs in the flat-lying coal mines of the Allegheny Field to the west. In 1898, the RICCo. began to use Harrison compressed air mining machines to undercut the coal seam prior to blasting, and installed electric haulage to dispense with mule-hauled coal trips. 48 The mining machines were abandoned within two years due to objectionable dust problems, 49 although, as the State Inspector of Mines noted in 1899, "The Majority of mines in this district are not well adapted for the use of mining machines, as the coal is low, and in many instances there is bone coal in the vein."50 In order to access coal seams without the development of new mines, in the 1890s the RICCo. adopted the practice of driving vertical tunnels from existing mines to access lesser seams. The advantages to the development of these new sources of coal were compromised by the cost of drilling, blasting, and hauling great quantities of waste rock.

The financial woes of the EBT began as the road was completed during the Panic of 1873, and the railroad "spent the

⁴⁵Daddow, p.301.

⁴⁶White, p.55.

⁴⁷White, p.66.

⁴⁸Coal Inspections, Harrisburg, rept's of the inspectors of coal mines, 1898, p.535, 1899, p.908.

⁴⁹Rainey, p.61.

⁵⁰Coal Inspections, Harrisburg, rept's of the inspectors of coal mines, 1899, p.909.

first three decades in a state of financial collapse."⁵¹ The RICCo. shipped 57,037 tons of coal during the first year of operation, and approximately 100,000 tons per year until 1883. Coal prices then fell and 1884 production was off by one third.⁵² Attempts by RICCo management in the early 1870s to cut coal mining labor costs through wage cuts resulted in periodic strikes and work stoppages at the mines and iron furnaces, disrupting operations and sales. At the iron furnaces, strikes became increasingly violent and protracted. The unrest caused by the Panic of 1893 culminated in a ten week strike, the banking of the iron furnaces, and the halting of ore mining.⁵³

The RICCo. recovered periodically, and was able to post higher coal mine production figures as it expanded its mining operations in the late 1890s. Coal shipments for the last decade of the century reflected the changing conditions of coal markets and production. The East Broad Top Railroad was extended to the new RICCo. company town and coal mine at Woodvale in 1891.54 In 1891, the first year for Woodvale Mine production, the Company shipped 166,385 tons of coal, and in 1892, 216,332 tons. In 1893, the iron furnaces were out of blast, and production dropped to 189,018 tons. Due to the strike and furnace shutdown of 1894, production dropped fifty per cent to 95,503 tons. Tonnages wavered between roughly 138,000 and 199,000 tons to 1900. In 1901 a four month long underground mine fire held production down, but in 1902, it was over 200,000 tons, and did not dip below that level until the railroad shut down in 1956. Coal production increased as a result of the consolidation of the Robertsdale mines through underground workings, the development of the Woodvale workings, and the mining of multiple seams from one mine. In 1898, President William Ingham implemented a plan to solve the Company's coal mining woes. In addition to the aborted mining machine experiment mentioned above, Ingham pushed the mines at Robertsdale and Woodvale through to the Fulton seam to increase output and implemented a market-specific advertising campaign for Broad Top boiler coal that netted a thousand tonper-day contract.55

⁵¹Rainey, 47. Rainey covers the financial trouble of the EBT, pp.43-60.

⁵²Rainey, p.44.

⁵³Rainey, p.57.

⁵⁴Rainey, p.55.

⁵⁵Rainey, p.60.

The East Broad Top did manage to make some additions and improvements to the property during the last quarter of the last century, despite its poor financial condition. During 1877-1880, the Railroad filled in several wooden trestles with furnace slag fill. This practice was in keeping with the narrow-gauge tendency to build cheaply, and then make improvements once some revenue was generated. Track extensions included the Booher iron ore mine branch, and the segment from Robertsdale to Woodvale, constructed in 1891. In 1884-1885, the Shade Gap Branch was constructed in anticipation of the construction of New York Central Railroad President William Vanderbilt's trans-Allegheny South Penn Railroad just a few miles to the south. The grandiose project fell through, and eventually the EBT extended the line to ore mining properties at Goshorn and Nancy in 1888 and 1890.

All of the EBT's steam locomotives were constructed by the Baldwin Locomotive Works of Philadelphia. Baldwin was better equipped and structured to build custom, narrow-gauge locomotives than any other American locomotive builder, and during the 1870s enjoyed 45% of the American narrow-gauge locomotive market. East Broad Top locomotive purchases between 1873 and 1906 show no unusual patterns. As weight and length of trains increased, the EBT quite logically purchased increasingly heavy locomotives with greater tractive force. Three locomotives purchased in 1873-1874, the Rockhill, Cromwell, and Shirley, all shared identical specifications, however, no particular drive wheel pattern or locomotive design emerged as a company standard until after the turn of the century.

Narrow-gauge engines in general were handicapped by their light weight and narrow fireboxes, that limited the quantity of steam and tractive force that could be produced. The EBT's solution to the tractive force problem was the incorporation of 48" diameter drive wheels starting with the 1887 <u>Tuscarora</u>. This dimension persisted for the rest of the EBT's locomotive purchases, and these drive wheels were the largest ever to equip American narrow-gauge engines. Shat the turn of the century, East Broad Top freight rolling stock was entirely constructed of wood, and most the Railroad's cars were constructed at the EBT shops or

⁵⁶BOD, in Keller, Vagel, "Excerpts from the EBT corporate minutes"Line Improvements, 1877-1917." <u>Timber Transfer</u>, v8no2 Summer 1991.

⁵⁷Telcon, Jack Brown, 6-8-94.

⁵⁸Rainey, <u>East Broad Top</u>, 214-215. A chronological chart showing EBT locomotive data and specifications.

by narrow-gauge car builders such as the Philadelphia firm Billmeyer and Smalls.

Although the iron and steel concerns of Pittsburgh had already begun to eclipse their Juniata Valley counterparts, the RICCo. relit one blast furnace on May 25, 1902. As a portent of the shifts then occurring in the iron industry, the furnace was charged with Minnesota hematite rather than the iron ores that were literally a stone's throw from the furnace. This phase of operation was brief, however, and on January 7, 1908, the Rockhill Furnaces were blown out for the last time, a victim of the Depression of 1908 as much as Pittsburgh competition.

In 1908, when the Rockhill Furnaces closed, the East Broad Top had been in poor physical condition for some time and had lost its captive coking coal market. ⁶⁰ Improvements to physical plant, market position, and transportation operations were all needed. But the factor that made the East Broad Top unique--its narrow-gauge--had not yet become a handicap to efficiency and profitability.

The technological changes that the railroads incorporated to overcome its narrow-gauge handicap are what make the EBT even more unique than commonly considered. The technological history of the EBT is really the set of twentieth century solutions to a nineteenth century problem. It is appropriate at this point to move away from the East Broad Top story in order to take a look at the narrow-gauge phenomenon.

THE NARROW-GAUGE CHOICE

At the first EBT Board of Directors meeting, on September 3, 1871, the Board authorized the survey of possible rights-of-way for "a railroad of either narrow or broad-gauge from the East Broad Top coal field to Mount Union..." The following year, the EBT Board "Resolved that the gauge of the railroad be fixed

⁵⁹Rainey, p.60.

⁶⁰Rainey, p.62-63.

⁶¹From notes taken from Minute Books of the East Broad Top Railroad and Coal Co. by George M. Hart, March 26 and 27, 1963, in archives of the State Railroad Museum of Pennsylvania at Strasburg, Pa. (hereinafter referred to as "Minute Books), p.1, minutes of 7-3-1871.

at three feet... "62, a decision perhaps driven by concern for construction costs.63

The EBT Board of Directors made an unusual and important decision when they chose the gauge of their new railroad. The choice of the three-foot gauge profoundly influenced the railroad's operations and technology. Today, the EBT's claim to fame, as touted in promotional literature, is that it is the only operating narrow-gauge railroad east of the Rocky Mountains. Beyond this distinction, however, the gauge has additional significance. Narrow-gauge railroads, that is those roads having a gauge less than today's standard-gauge of four feet, eight and one-half inches, were a new phenomenon in the United States in 1872. The East Broad Top was only the fourth railroad in the United States to adopt the unproven narrow-gauge technology when construction began in 1872.

The narrow-gauge movement began in England. British railroad development in the first half of the nineteenth century was characterized by controversy over the number of railway gauges in use and their incompatibility. The four feet, eight and one-half inch gauge, introduced by locomotive inventor George Stephenson, enjoyed support as the standard-gauge for Britain, and was also emerging as a favored gauge in America. Narrow-gauge railroads were known to be practical for mining and quarrying operations, where light locomotives hauled loads on steep grades and sharp curves. The most notable British narrow-gauge proponent was Robert Francis Fairlie who, after successfully developing a narrow-gauge railway for a Welsh slate quarry, began to promote his narrow-gauge concepts and locomotives. In 1870, Fairlie presented a paper, "On the Gauge of the Railways of the Future," to the British Association for the Advancement of Science. This paper, widely circulated in the British and American railroad trade press, articulated Fairlies' main contention: "The deadweight of trains conveying...goods is in direct proportion to the

⁶²Minute Books, 6-6-1872.

⁶³Rainey, Lee. and Frank Kyper. <u>East Broad Top.</u> San Marino, Ca: Golden West Books, 1982. p.29, "Apparently both original surveys projected costs beyond what the company could bear. Thus at a special stockholder's meeting held June 6, 1872, a momentous decision was made—the road would be built to a gauge of three feet."

⁶⁴Rainey, p.29. The other narrow gauge railroads were the Denver and Rio Grande, the Painesville and Youngstown, and the Tuskeegee.

gauge on which they run; or in other words, the proportion of non-paying to paying weight...is increased exactly as the rails are farther apart..." The basic premise of the narrow-gauge advocates was that the cost of building and the efficiency of running a railroad bore a direct relationship to its gauge, and that economies were to be realized wherever smaller equipment was used. Fairlie contended that a narrow-gauge railroad cost as much as 33% less to build than a standard-gauge line, and that narrow-gauge freight cars possessed a better deadweight, or tare-to-net ratio than standard-gauge cars, allowing them to haul more cargo per ton of car. 66

By 1870, the railroad gauge question in America was nearly resolved. The dense mileage in the industrialized northeast was almost all standard-gauge, but the rest of the country was "a hodgepodge of gauges," many of which were in the process of conversion. An early proponent of the American narrow-gauge movement was Howard Fleming, whose influential book Narrow-Gauge Railways in America was published in 1875. Fleming shared Fairlie's beliefs regarding narrow-gauge economies, claiming that "The cost of constructing a railway is nearly as the width of its gauge," and claiming for the narrow-gauge, "A savings, in first cost of construction, equal to thirty-three per cent..." According to Fleming, cuts and fills could be made narrower, reducing the cost of earthworks in building the railroad; sharper radius curves could be employed; and lighter locomotive weight allowed for less expensive, lighter rail.

During the "Narrow-Gauge Fever," proponents and opponents made conflicting claims regarding the costs of construction and operation of narrow-gauge railroads. Much of the statistical data generated in favor of the narrow-gauge was doubtless manipulated

⁶⁵Fairlie, Robert Francis, "On the Gauge for the Railways of the Future," address given to the British Association for the Advancement of Science, September 19, 1870, as quoted in Hilton, George W. <u>American Narrow Gauge Railroads</u>, Stanford: Stanford University Press, 1990, p.16.

⁶⁶White, p.79-80.

⁶⁷White, p.80; Hilton, p.35.

⁶⁸Fleming, p.12.

by its promoters.⁶⁹ The detractors of the narrow-gauge had a powerful spokesman in M.N. Forney, who became editor of the <u>Railway Gazette</u> in 1870. Forney reasonably concluded that the cost of surveying and land was the same for different gauge railroads. On the issue of construction, however, Forney calculated that the cost of cuts and fills was far more dependent on the grade than the gauge of the line to be built, and that as the size of earthworks increased, the anticipated percentage of savings actually decreased.⁷⁰

Ultimately, it is difficult to duplicate or verify the calculations made on both sides of the narrow-gauge argument. In 1922, well after the "Narrow-Gauge Fever", noted railroad executive Lenor F. Loree stated that "the economic difference in the two systems are largely confined to the original cost and the maintenance of the permanent way and equipment." Loree noted that the cost to maintain a narrow-gauge right-of-way in 1917 was twenty-five per cent of the cost to maintain a standard-gauge line. Regarding the cost issue, Hilton concludes "It is evident that the builders more than fulfilled the projections of the proponents for low-cost capital entry into railroading."

Another important argument made in favor of the narrow-gauge was that narrow-gauge rolling stock had a more favorable deadweight, or tare-to-net ratio than standard-gauge. Fleming, using examples of narrow-gauge equipment compared to broad-gauge, demonstrated that the deadweight ratio of the narrow-gauge cars was favorable. In the case of an early wooden EBT coal hopper, Fleming found that the narrow-gauge car weighed 9,000 lbs, had a capacity of 20,000 lbs., and a tare-to-net ratio of 1:2.22. A standard-gauge car of the same type weighed 18,000 lbs., had a capacity of 36,000 lbs., and a tare-to-net ratio of 1:1.6, a less favorable ratio. The leming argued that narrow-gauge cars hauled more per pound of car, and that this was an advantage. However,

⁶⁹According to Hilton, the "most intellectually valid" statistics were probably those presented by the "Special Committee of Eleven" who reported to the first Narrow Gauge Convention in St. Louis, June 19-20, 1872. p.48.

⁷⁰White, p.85.

⁷¹Loree, Lenor F. <u>Railroad Freight Transportation</u>. New York: D. Appleton and Company, 1922. p.119.

⁷²Hilton, p.215.

⁷³Fleming, p.56-57.

the typical narrow-gauge car had one-half to three-quarters the capacity of a standard-gauge car. As expressed simply by White, "Since the cars were smaller, it took a greater number to move a given quantity of goods." 74

The issue of tare-to net ratio was ultimately unimportant, since the most significant factor in freight car design is the cubic volume of the car. The more tons a railroad can move per mile over the road with a given train of a certain length, the greater the revenue generated by that train. According to Hilton, between 1870 and 1899, "...car designers of the major railroads dealt with the problem by moving to successively larger cars with more favorable area-to-volume ratios." Luckily for the East Broad Top, the tare-to-net ratio for narrow-gauge cars hauling the heavy, dense loads found in mining and mineral regions was more favorable than any other sort of load. Eventually, however, the EBT had to confront this issue, and constructed its own specialized high-volume coal hopper cars.

In addition to a lower tare-to-net ratio, the other great practical obstacle faced by the narrow-gauge railroads was the requirement to break bulk, or manually transfer freight car ladings between cars of differing gauges at interchange terminals. The cost to the railroads in time and labor was far greater than the simple interchange of like-gauge cars. The issue of the added labor cost inherent in break-bulk transfer of freight between railroads of dissimilar gauges was not dealt with by the narrow-gauge proponents; Fairlie himself dismissed the issue as merely a "bugbear."

The narrow-gauge railroads developed several technological responses to this problem. Most involved jacking up rolling stock or lifting it with cranes to swap trucks; even trucks with variable gauge axles were proposed. The most notable example of

⁷⁴White, p.86.

⁷⁵Hilton, p.173.

⁷⁶Hilton, p.69.

[&]quot;White, "Narrow Gauge Fallacy," 88. White does admit that due to a lack of primary data on this kind of transhipment, "finding precise costs has proven extremely difficult."

⁷⁸Fairlie, "Railways of the Future," quoted in White, "Narrow Gauge Fallacy," p.80.

these interchange devices was Robert H. Ramsey's "Ramsey Car Transfer Apparatus," patented in 1876. The Ramsey Transfer was:

...a long pit with standard-gauge tracks at one end, and narrow-gauge at the other. Supported by dollies at the side sills, a car was drawn across the pit so that its standard-gauge trucks rolled free of the carbody and into the pit. At the other end, narrow-gauge trucks with special center plates and heavy-duty journals were pulled up out of the pit and attached to the car. The entire job took less than two minutes.⁷⁹

Although the Ramsey Transfer required the use of modified trucks, it proved popular and was used on numerous narrow-gauge railroads, some employing as many as five or more on one system. 80 Another transfer device used to swap trucks of incompatible gauges was the transfer crane, which usually straddled the tracks and literally lifted the broad or standard-gauge carboy while the specially-modified narrow-gauge trucks were swapped, one end at a time. This was also a popular solution; in 1886 the Louisville and Nashville Railroad employed nine of these to interchange with other roads. 81

In 1883, ten years after the East Broad Top started running trains, the President of the Railroad reported that the Pennsylvania narrow-gauge Bell's Gap Railroad was soon to convert to standard-gauge, and that their Ramsey Transfer equipment would become available. Apparently the EBT tested this equipment over their road and found that it would fit all clearances. According to the president, "...adoption of the Ramsey Transfer [was] earnestly recommended." The main cost was not in the transfer itself, but in the special trucks, which were quoted at \$200.00 per unit. It is not clear that the Ramsey equipment was specifically considered for smoothing interchange with incoming standard-gauge cars. The tests consisted of moving broad-gauge "hopper gondola cars carrying 40,000 lbs." through the coal stock houses and tunnels, insuring that they had sufficient clearance to dump from a loaded car, and moving a standard-gauge box car of coke through the tunnels. The testing of this equipment for outbound coal and coke traffic, rather than incoming general

⁷⁹Rehor, John A. <u>The Nickel Plate Story</u>. Milwaukee: Kalmbach Publishing Company, 1965, p. 127. Hilton, p.254, gives a time of four minutes.

⁸⁰Hilton, p.254-256.

⁸¹Hilton, p.35.

merchandise, suggests that the EBT was either considering the use of broad-gauge rolling stock on narrow-gauge trucks as a way of increasing the ton-miles hauled by on-line mineral trains, or smoothing interchange with off-line coal customers, rather than as a way to eliminate break-bulk transhipment, as the Ramsey Transfer was intended. The Ramsey equipment was not purchased, and the EBT did not address the transfer issue again until 1933, when it incorporated a transfer crane into its Mount Union terminal operations.

THE EBT: NARROW-GAUGE

It is not possible to know exactly what influenced the EBT Board of Directors to consider the possibility of narrow-gauge; no doubt they knew of the three other such lines in America then under construction. There was some notable American literature on the subject published before the EBT's decision was made in June of 1872. Most of the popular and trade literature touting narrow-gauge, such as Fleming, came after the EBT was constructed, and most of the anti-narrow-gauge pamphlets came before the EBT's choice. Ironically, the decision to build the EBT to a three-foot gauge was made just thirteen days before the first Narrow-Gauge Convention, a promotional event held in St. Louis, Missouri.

The EBT was conceived and developed too early to have been one of the many ill-fated railroads which were built during "narrow-gauge fever". Narrow-gauge railroads had a bad reputation in many circles as purely speculative ventures, and many were indeed poorly constructed. The EBT, however, was built with grades and curves consistent with a broad-gauge line, not just laid on the surface of the ground, as was the case with some narrow-gauge roads. The gauge choice was apparently an informed, conscious cost-saving decision, with some basis in reality. The EBT ran several surveys, and ultimately made serious investment in two tunnels to crest grades. The grade profile used by the EBT followed flat terrain through valleys, and assaulted

⁸²Minute Books, 1-16-1883.

⁸³See Hilton, p.23, footnotes 79-81. also Hulbert.

⁸⁴Hilton, passim.

⁸⁵Maximum gradient, 2.6; maximum curvature, 17 degrees.

the hills with short, steep grades. When railroad was laid with forty lb. rail, when thirty lb. was considered adequate for the day, and many less-committed roads used even lighter rail. Finally the EBT became conscious of transfer and volume issues, as evidenced by the consideration of the used Ramsey transfer equipment.

Although narrow-gauge had its critics, and ultimately failed to realize its goals, the primary literature and contemporary scholarship regarding the cost arguments of the Narrow-Gauge Movement suggest an ideal set of circumstances under which the use of a narrow railroad track gauge could be considered practical or even advantageous. Noted railroad scholar John H. White, in his article, "The Narrow-Gauge Fallacy," which takes a disparaging view of narrow-gauge proponents, does admit "I would even agree that for certain branch lines or industrial railways-particularly those with a one-way mineral traffic--a narrow-gauge could be as efficient as a broad-gauge."87 In 1878, German railway engineer Baron M.M. von Weber claimed that narrow-gauge railroads were only suited to carrying bulk mineral commodities such as ore, stone, or coal, and perhaps light passenger service. Weber stated that narrow-gauge railroads should be built for lines with steady volume, should have as few points of interchange with standard-gauge railroads as possible, and should avoid mixed traffic. 88 The ideal, practical narrow-gauge railroad was therefore seen as a one-way, mineral-hauling "feeder line" of short length, with one point of interchange, and as little breakbulk traffic as possible.

The East Broad Top Railroad conformed to the above profile and was, therefore, a good candidate for survival where other narrow-gauge railroads failed. Left to stand alone with its 1870s technology, however, the railroad would likely have failed after the turn of the century. The East Broad Top survived, and even prospered, in part due to modernization efforts in keeping with those on standard-gauge roads; but also critical was the internal development of equipment and technology specific to the task of overcoming the inherent handicaps of the narrow-gauge.

⁸⁶Loree, p.11-16.

⁸⁷White, p.78.

⁸⁸Weber, Baron M.M. von. "The Proper Gauge for Cheap Railroads," <u>Railway Gazette</u>, 10, 1878, pp.343-46. as discussed in Hilton, p.69.

THE EAST BROAD TOP RAILROAD, 1903-1956

Although the RICCo. iron furnaces did not shut down permanently until 1908, operations were interrupted prior to the shutdown, and the proximity of local raw materials was no longer an advantage. By the start of the twentieth century, the end was in sight for the RICCo. furnaces. In order to remain a viable company, the RICCo. had to make a shift from operations that centered around iron manufacture and internal consumption of raw materials, to the transportation and off-line marketing of Broad Top bituminous coal. Naturally, the EBT was the conduit for this coal traffic; however, the railroad, with its poor track bed, light rail and bridges, and motley collection of locomotives was not in physical condition to become a busy coal hauler.

Between 1903 and 1913, the physical plant of the East Broad Top Railroad was brought up to standard-gauge railroad standards through the improvements directed by EBT and RICCo. president and general manager Robert S. Seibert. The improvements and expansions Seibert set in motion, enabled and prepared the EBT to mine, transport, clean, and interchange coal in quantities that made the EBT/RICCo. the largest producer of coal in the Broad Top field.

In terms of technological improvements to the EBT, the actions and influence of Seibert were the greatest of any one person associated with the railroad. Robert Seibert had originally worked as the railroad's general freight and passenger agent in from 1878 to 1881. He then worked his way west across the United States, working for various lines as dispatcher or station superintendent. The sale of a line of which Seibert was a partial owner left him wealthy, and he returned to Pennsylvania. In June of 1903, Seibert returned to the EBT, and toured the line with the management. By October, Seibert was appointed both president and general manager of the EBT and the RICCo., and he began to revitalize the railroad.⁸⁹

In the autumn of 1904, Seibert contracted with the American Bridge Company to replace the largest bridge on the railroad, the Pogue trestle. When completed, the bridge consisted of two 105-foot truss spans, and a 65-foot deck girder span, and was constructed to bear the weight of standard-gauge equipment. In addition to the Pogue bridge, Seibert replaced seven other

⁸⁹Charles Howard Welch, <u>History of Mount Union</u>, <u>Shirleysburg</u> and <u>Shirley Township</u> (Mount Union, Pa. The Mount Union Times, 1909), 247. Also see Rainey, <u>East Broad Top</u>, 69.

bridges. Seibert ordered the entire railroad, originally laid with 30 lb. rail, to be re-laid with 60 lb. rail between 1904 and 1909; rebuilt the roadbed with cinder ballast and oak ties; relined the two tunnels with new timbers; improved yards, sidings, locomotive coaling and watering facilities, and stations, including the construction of the renamed "Orbisonia" station and office building at Rockhill Furnace in 1906; the shops (described in a separate section). Under Seibert, the Rocky Ridge branch was constructed to serve new coal mines in 1905, and the Shade Gap branch was extended to Neelyton in 1909.

These kinds of improvements were unusual for a narrow-gauge railroad. According to Hilton, "Superficial improvements might be made in rails and ties or even ballast, but systematic upgrading of the large number of bridges and trestles on the typical narrow-gauge was too large an undertaking to be practical in the short run." Obviously, however, the EBT was not in it for the "short run."

Seibert's improvements were not limited to track and structures. The EBT also needed more powerful locomotives, and the railroad worked with Baldwin to develope a locomotive type suited to its needs. The solution to the small firebox dimensions of the narrow-gauge engines was Baldwin's 1892 development of the trailing truck, which could support a wider firebox located behind, rather than between, the driving wheels. In 1908, the EBT ordered the number 11, a trailing-truck locomotive with a 2-6-2 wheel arrangement. With the 48 inch drivers and a firebox grate with 50% more area than any previous EBT locomotive, the 11 provided 16,000 lbs. of tractive force, a modest gain over some of its predecessors. 91 The success of the 11 led to the purchase of the 12 in 1911. The 12 had a 2-8-2, or Mikado-type wheel arrangement, and was an extension of its 2-6-2 predecessor. The 12, with its larger cylinders, firebox, and boiler, and 48 inch drivers, produced 22,100 lbs. of tractive force. In 1912, the EBT requested a similar locomotive from Baldwin, which was to be as large and powerful as the new 60 lb. rail would allow. The boiler of the No. 14 was 33% larger than that of the 12, and the locomotive produced 27,600 lbs. of tractive force. Railway Age <u>Gazette</u> said "...the new locomotive is similar in its proportions to many of the most successful standard-gauge locomotives having

⁹⁰Hilton, American Narrow Gauge, p.228.

⁹¹Rainey, <u>East Broad Top</u>, p.90; locomotive specifications chart on 214.

the same wheel arrangement."92

The EBT had settled on the Baldwin 2-8-2 design, and ordered four more of the Mikado type between 1914 and 1920. The 15, built in 1914, was a sister to the 14. The 14 was considered successful, as it could haul forty cars where the older EBT locomotives could haul only eighteen. The 15 was ordered specifically as a response to the increased tonnage coming from the Jacobs coal mine. The final three locomotives ordered by the EBT--the 16, 17, and 18, were of a similar but even larger design, and were capable of producing 30,600 lbs. of tractive force. These "superpower" narrow-gauge steam engines, which weigh just over eighty tons, are some of the largest American narrow-gauge locomotives ever built, and can be considered standard-gauge engines on narrow-gauge wheels. The EBT Mikados "were part of the most complete upgrading of any of the narrow-gauges to scaled-down modern standard-gauge practice."

Reactions to Seibert's improvements were glowing: "...the road has been brought into an almost perfect state...the track today is in as good a condition as that of the Pennsylvania." The self-sufficiency of the railroad was also noted: "... the equipment is ... complete ..., the company being able to build their own cars and remodel their own coaches and locomotives." The most telling indication of Seibert's significance appeared in the September 9, 1904 Mount Union Times: "The East Broad Top Railroad is in excellent condition, the road bed, rails, ties-everything in perfect order, and we cannot but realize a great change from a few years ago...we must inevitably conclude that the East Broad Top is a narrow-gauge railroad with a broad-gauge president."

⁹²Railway Age Gazette (June 27, 1913), 1606, quoted in Rainey, East Broad Top, p.93.

⁹³Rainey, East Broad Top, p.93.

⁴Hilton, American Narrow Gauge, p.487.

⁹⁵Welch, <u>History of Mount Union</u>, p.243.

[%]Mount Union Times (Mount Union, Pa.), 22 Oct. 1909, quoted in Welch, History of Mount Union, 245.

⁹⁷Mount Union Times (Mount Union, Pa.), 9 Sept. 1904, quoted in Rainey, East Broad Top, 71.

The spirit of the Seibert improvements--increasing the capacity of the railroad to handle more coal traffic--extended beyond the end of his tenure in 1913. In 1914, the railroad replaced its Aughwick Mills bridge with an early example of a reinforced concrete bridge. At 203 feet, with four forty-three and one-half foot arches, it was the largest concrete structure on the railroad, and the second longest bridge. 98 Since Seibert was president and general manager of both the RICCo. and the EBT, improvements to the railroad accommodated the development of greater coal traffic from new RICCo. mines at the new company town of Alvan, Rockhill Nos. 7 and 8, built 1915-1916, and No.9, opened in 1917. Seibert's improvements were critical, especially in terms of coal traffic: "Traffic in the 1920s was the heaviest in the railroad's history, peaking in 1926 at 25,725,546 tonmiles, about 80% coal."99 In anticipation of the increased need for coal processing, the RICCo. put a new conveyor coal sorting plant in operation at the Mount Union yards in 1914. The plant was capable of processing 250 tons of coal per hour. This plant relied on manual labor for picking slate from the coal. 100

By the First World War, the EBT recognized the need to replace its wooden coal hoppers (capacity of ten long tons), with cars that matched the hauling capabilities of the its new locomotives. The road anticipated increased coal traffic with the further development of Rockhill mines 7, 8, and 9. Moreover, narrow-gauge railroads were generally at a disadvantage because the capacity of rolling stock was lower than standard-gauge equipment. Whether on a standard or narrow-gauge railroad, larger cars were becoming a trend in railroad improvements. According to railroad president and authority Lenor Loree,

The weights of locomotives are being constantly increased, and to get the greatest earning power for these locomotives and secure the benefit of the large sum expended in improvements of road, it is necessary to have cars that will carry the greatest possible load without increasing the length... the large car, from a weight carrying standpoint, seems every way desirable for many lines that have special traffic, such as ore, coal, stone, brick and metal, where the cars can be

⁹⁸ Rainey, Timber Transfer 1, no.6, (Sept-Oct 1984), p.6-7.

⁹⁹Hilton, American Narrow Gauge, p.487.

¹⁰⁰Alphonse Brosky, "Sand Flotation Process Enters Bituminous Field," Coal Age, (3 Dec. 1925): p.769.

made to carry full loads in at least one direction. 101

In 1912, the East Broad Top ordered ten all-steel, 30-ton capacity twin-hopper cars from the Pressed Steel Car Company of Chicago, the only fleet of such cars built for narrow-gauge railroads. With the construction of larger freight cars, steel was gaining popularity as a building material: "In the construction of freight cars, as of passenger cars, steel is being extensively employed. In fact, the building of cars with a capacity of 50 tons or more has been made possible only through the use of steel...in the body of the car. Coal cars are now made almost exclusively of pressed steel..."

The EBT's new cars were "...essentially scaled-down hoppers of the time. With a tare weight of 28,800 lbs. and a capacity of 60,000 lbs., they had a tare ratio of about 1:2.9, which was not exceptional." Although the cars had greater volume than their wooden predecessors, they were not entirely satisfactory because their high center of gravity caused derailments. The EBT also bought thirty longer two-bay cars from the PSCCo., which were designed to overcome the swaying problem of the earlier cars.

In 1914, the EBT, having shops capable of freight car construction, embarked on a coal hopper car construction campaign, building 180 cars in five years. These cars were constructed with three bays, or hoppers, instead of the original two, a modification that added five tons to the capacity of the cars. ¹⁰⁴ The East Broad Top ultimately built 274 three-bay, steel coal hoppers, ending its car construction program in 1928. In addition, the company rebuilt most of the old two-bay cars with three bays. From 1943 to 1949, many of the hoppers had their capacity boosted again to 80,000 lbs. by the addition of a 14" steel band around the top of the car. ¹⁰⁵ These cars were dedicated to hauling coal, while the low-sided cars remained in general service. ¹⁰⁶ The dispatching of high-volume coal trains to

¹⁰¹ Loree, p.74.

¹⁰² Johnson, Emory R. and Thurman Van Metre, <u>Principles of Railroad Transportation</u> D. Appleton and Co., NY 1924, p.68.

¹⁰³Hilton, p.187.

¹⁰⁴Rainey, p.97-99

¹⁰⁵Rainey, p.227. Chart.

¹⁰⁶Rainey, p.158.

Mount Union was important not simply to deliver as much coal as possible to market, but also to best utilize the throughput capabilities of the coal processing equipment, which did not generate revenue when idle.

The most important technological improvement made to coal operations was the construction of a new coal washing facility at Mount Union in 1925, replacing the 1915 conveyor sorter. Construction of the new facility was motivated by the need to continue to supply customers with clean coal while handling the greater volumes coming from the mines. With the opening of Rockhill mines 7, 8, and 9, between 1915 and 1917, the Rockhill Coal and Iron company was operating six mines with annual coal production of approximately one-half million tons. 107 These new mines tapped the Fulton Bed, which was split by a significant slaty parting. Due to the wavy configuration of the seam and the absence of mechanical mining machines, the coal was "shot off the solid," leaving broken partings distributed in run-of-mine coal. Broad Top coal markets such as the ceramics and brick industries needed a clean fuel, and the clean-burning properties of the coal had to be maintained to secure the urban markets. By the early 1920s, the manual picking process in the 250 ton-per-day conveyor sorter was unable to keep the ash content of the coal to a consistently low level, and the quality of the coal suffered with increased production. 108

A discussion of the Fulton seam in a 1926 Pennsylvania Topographical and Geological Survey publication, notes that "Locally, the bed contains an appreciable amount of shale, which makes its future commercial value doubtful unless the coal is carefully cleaned." In 1924, the Madiera, Hill Co. realized that they needed a way to integrate increased production with consistent cleaning, and began looking at alternatives to manual picking. The company adopted the sand flotation system of H.M.Chance & Co., of Philadelphia. This system was previously used for anthracite coals starting in 1921, and the Mount Union plant was the first application of this process in the bituminous industry.

¹⁰⁷Coal Reports, years given.

¹⁰⁸Brosky, Alphonse. "Sand Flotation Process Enters Bituminous Field," Coal Age, dec.3, 1925, p.769.

¹⁰⁹Sisler, James D. <u>Bituminous Coal Fields of Pennsylvania--Part II--Detailed Descriptions of Coal Fields</u>. Pageolsurv, harris, 1926, p.276.

In the Chance process, unwashed coal was introduced into an inverted conical vessel filled with a mix of sand and water. The mass was kept fluid by upward current and agitation. The specific gravity of the sand and water slurry was such that the lighter coal collected at the top, and the waste material fell to the bottom. The specific gravity could be manipulated according to need by varying the proportion of sand and water. 110

The completed two-cone Chance coal washing plant had a capacity of approximately 500 tons per hour and made "marked reductions in ash and sulphur content of the product". The new classifying apparatus raised the number of specialty sizes produced by Madiera, Hill from five to nine. The Chance plant is widely credited for the EBT's great prosperity in the 1920s, its survival of the depression, and its rise above producers on the west side of the Broad Top Field who had not modernized to a similar degree. Indeed, in the mid-1920s, the RC&ICo. shipped the highest tonnages the company had yet attained. The high production figures are due to the maturation of the Rockhill Nos. 7, 8, and 9 mines, opened 1915-1917, and not the installation of the Chance plant alone.

¹¹⁰Chapman, Ron. "The Chance Coal Plant at Mount Union, Part 1: The Chance Process." Timber Transfer, v3, no4, oct.nov. 1986 p.13.

¹¹¹Figures vary, and not all coal was washed. Brosky, p.771, says 500 tph, 335 washed; and Chapman, p.10, says 500 tph, 300 washed. Rainey says 275 tons, with 125 washed,p.127. The Rainey figures would hardly indicate an improvement over the 250 tph conveyor sorter; Brosky, p.771,773.

¹¹² See Brosky, p.769; Chapter 9; Rainey, p.127.

¹¹³Rainey, p.127.

differ from source to source. For example, EBT receiver J. William Wetter, in The Broad Top Bulletin (June 16,1950), claimed that RC&ICo. production was greatest in 1924, the year before the Chance plant went on line, with 613,736 tons produced. This conflicts with Rainey, East Broad Top, 126, who claims that 1926 was the most productive year. According to Pennsylvania, Reports of Inspectors (1924), the RC&ICo. produced 628,920 tons that year. Rainey, East Broad Top, 126, claims a figure of 691,800 tons for 1924. These discrepancies may be explainable in part due to the fact that State and Federal mine reports, as well as other sources, usually listed coal produced and/or coal shipped, the latter figure usually a fraction smaller than the former. Obviously, the development of new

Perhaps too much attention has been paid to the Chance plant's dual role as a transfer facility. In addition to preparing coal, the plant is noted for eliminating the transfer of coal to standard-gauge cars by combining transfer and cleaning operations. It should be realized, however, that the 1915 conveyor did essentially the same thing. Additionally, a portion of the coal sent to the plant was not washed, as some of the EBT's coal customers purchased unwashed, run-of-mine coal. If this were the case for any off-line customers, the coal would have to have been transloaded anyway. The Chance plant was far more important as a washing facility than for its contribution to streamlining of materials flow.

The EBT was equally creative in dealing with the problem of transferring freight from standard to narrow-gauge track. The EBT Board of Directors never followed up on the installation of a Ramsey Transfer device, under consideration during the first years of the Railroad. Perhaps this was because so little breakbulk freight was handled by the Railroad and, as planned, it was mostly a coal-hauling line. In the 1930s, however, the advent of the gasoline-powered motor truck cut into the EBT's non-mineral traffic. In 1933, the Railroad implemented what was known as the "timber transfer" to lift standard-gauge cars off their trucks and replace the trucks with narrow-gauge ones for the ride on the EBT.

The timber transfer was a crane that straddled two tracks in the Mount Union yard. Originally operated by the McKelvey Brothers Lumber Company, this crane had literally been used to transfer lumber cars between adjacent narrow and standard-gauge cars. The timber transfer was quite simple. One end of a standard-gauge car was spotted under the crane, and the end was lifted so that the truck could be rolled out onto a side track while a narrow-gauge truck was wheeled in to replace it. The car was lowered, and the process was repeated at the other end of the car. The entire process took half-an-hour. Since the narrow-gauge coupler was 75% smaller, and mounted lower than the standard-gauge coupler, the EBT connected the cars with an S-shaped aluminum adaptor. 116

mines was the factor in increased coal production, rather than the ability to efficiently clean and classify the coal. As noted in the text, not all coal was put through the Chance plant before shipment.

¹¹⁵Rainey, p.127.

¹¹⁶Rainey, p.144-145.

The timber transfer had positive and negative aspects. The conversion to standard-gauge cars for non-mineral service enabled the EBT to eliminate most of their non-hopper freight car fleet, with an attendant savings cost. The transfer helped generate the most revenue for the railroad during 1939-40, when the EBT carryied materials for the construction of the Pennsylvania Turnpike. The use of standard-gauge cars that were wider and tended to sway necessitated the purchase of sets of special narrow-gauge trucks with "oversized axles and journals" and "heavy lateral plates that arched above the sideframes to engage the bolsters of the car. The According to one account, "the EBT's high maintenance standards for roadbed and track structure kept sway of standard-gauge cars on narrow-gauge trucks within manageable limits at normal operating speeds. This is in direct contrast to a firsthand account by John White:

I personally observed the operation of a standard-gauge box car on the East Broad Top in 1953. A conventional 40 foot car remounted on narrow-gauge trucks, it was placed at the rear of the train so as to be under the watchful eye of the conductor. The crew was nervous, and rightly so considering the wild swaying of the car-it became so alarming at one point that the conductor was ready to pull the air. He admonished the engineer for excessive speed at the next stop, yet I am sure we never exceeded 25 mph. 121

Somewhat ironically, the problem may have been the good track. Sway is a result of harmonic vibration of the topheavy car, a phenomenon which would have been canceled out by bumpy track! In any case, there were no accidents on the EBT resulting from the practice in two decades of operation. 122

The Mount Union yards themselves were highly efficient in terms of the location of the coal preparation plant at the point of material transfer. This efficiency extended to the arrangement

¹¹⁷ Rainey, p.145.

¹¹⁸Grenard, p.24.

¹¹⁹White, p.259.

¹²⁰Grenard, p.24.

¹²¹White, fn35 in "the Narrow Gauge Fallacy", Railroad History, v141, 1979, p.95.

¹²²White, p.262.

of standard, narrow, and dual-gauge trackage. Dual-gauge tracks, "probably the most common [gauge] compatibility device," enabled common-gauge access to the timber transfer, and direct movement of coal and ganister into the GREFCO and NARCO refractory plants. The EBT switchers at Mount Union were standard, not narrow-gauge, likely due to the preponderance of standard-gauge Pennsylvania Railroad track and the interchange layout. The EBT switchers were equipped with standard-gauge couplers and a lower, smaller, swing-away narrow-gauge coupler so that they could haul cars of either gauge.

The EBT did not hesitate to make capital investments in technological innovations that boosted the Railroad's revenues. In contrast, however, the railroad adhered to antiquated safety technologies it considered economically unimportant to its operations. Both the geographical and industry isolation of the narrow-gauge roads (which never had an independent trade association) gave them the freedom to retain equipment and practices that were illegal under the Federal Safety Appliance Act of 1893. This act made the replacement of deadly link-and-pin type car couplers with the MCB or Janney knucle-type coupler mandatory, as well as the replacement of hand-operated brakes with Westinghouse automatic air brakes. 124 The EBT had not complied with the act by 1908. However, under threat of legal action, the railroad began to install Janney couplers, and in 1913 began to apply Westinghouse brakes to its rolling stock. 125 Another dangerous activity no doubt carried on at the EBT was the poling of cars. Poling was a method of moving a car or cars on an adjacent yard track or siding by placing a stout pole between cast iron pockets located at the closest corners of a freight car and switching engine. Poling accidents were notorious, and the practice was outlawed. Not only do most EBT freight cars have poling pockets, but all locomotives still have their poling poles hanging beneath their tenders.

Although the EBT was primarily a freight hauling railroad, it did operate passenger train service with varying degrees of success for most of its history. During the boom years of the first decades of this century, passenger service was busiest: for example, 150,000 passengers rode the railroad in 1912. 126

¹²³White, p.267.

¹²⁴Hilton, American Narrow Gauge, p.187-188.

¹²⁵ Rainey, East Broad Top, p.97.

¹²⁶Rainey, <u>East Broad Top</u>, p.88.

Passenger counts rose in the 1910s due to miners who commuted to work by train. As a result of this increase the railroad purchased several wooden passenger cars from other narrow-gauge railroads, including the Boston, Revere Beach and Lynn. 127 Several of these wooden passenger cars are still in use on the EBT, and are some of the oldest passenger equipment still in revenue service in the United States.

The number of passengers declined during the 1920s, and fluctuated dramatically during strike periods. Instead of wasting steam locomotive power on nearly empty passenger trains, the EBT decided on the flexibility offered by a technological solution chosen by many American railroads facing similar problems at that time--the self-propelled gas-electric motorcar, or "doodlebug," as it was affectionately called. In 1926, the EBT ordered parts for a motorcar from the J.G. Brill company of Philadelphia. The motorcar had a 250 h.p. gasoline engine, which drove an electrical generator and traction motors manufactured by Westinghouse. The M-1, as the EBT designated its first motorcar, was assembled at the EBT shops. The interior layout of the M-1 was that of a "combine," in that it served multiple purposes. The M-1 has seats for twelve passengers, a baggage compartment, and a railway post and express office. 128 The M-1, which cost roughly half as much to operate as a steam locomotive, went into service in 1927, and was used for the mining commuters, mail and package delivery. The M-1 was used for main line assignments until 1931, and on the Shade Gap branch until 1935. Subsequently the motorcar was used instead of regular trains when mining passenger traffic was down, and even for light switching. 129 Many "doodlebugs" survive today, used by high-tech rail inspection companies such as Sperry Rail Service. The EBT's M-1 is not especially significant from a technological standpoint, other than its status as the only self-propelled gas motorcar ever built for a narrow-gauge railroad. Passenger service continued on the EBT in the form of a "mixed" train, with the caboose, the usual accommodation, until August 15, 1954, the day that the last deep, or underground coal mine closed.

Although in terms of revenue and volume, coal was by far the most significant commodity hauled by the EBT, in 1919 a second mineral product added to the railroad's carloadings. Ganister rock, a term applied to any quartzite assaying over 96% pure

¹²⁷Rainey, East Broad Top, p.112.

¹²⁸ Grenard and Kramer, To the Mines and Back, p.76.

¹²⁹Hilton, American Narrow Gauge, p.487.

silica, was commercially desirable for the manufacture of refractories primarily for the iron and steel industry. This hard, white rock forms many of the ridges in the Appalachian Mountains, and great floes are visible from the EBT right-of-way.

The development of refractories was largely linked to the growth of the modern steel industry, which consumed 60% of all refractories made by 1900. Is Ground silica, a chemically basic material, was bonded with alumina clays to form bricks that had a high fusing point and expanded and had great strength when hot. Is Refractories in the form of bricks, specialty shapes, and moldable materials lined chemical and metallurgical vessels such as coke ovens and open hearth furnaces, helping them withstand high heat and chemical abrasion.

Mount Union, surrounded by mountains covered with ganister, eventually became "the silica brick capital of the world." In part, this was due to the proximity of raw material and the Pennsylvania Railroad. Equally as significant, the brick plants lay at the end of the EBT Railroad and a plentiful source of hot, clean-burning kiln fuel--Broad Top coal. In 1900, the W.H. Haws Fire Brick Company became the first plant in America entirely devoted to silica brick manufacture. The Haws plant was immediately purchased by refractories giant Harbison-Walker, who obtained its ganister in the Mount Union area; the following year, the Mount Union Silica Brick Company opened. By 1910, H-W and MUSB were the largest and second-largest refractory brick plants in the World, consuming "240 tons or more" of Broad Top coal per day, "providing the RI&C Co. with a steady market for the first time."

In 1911, a third brick plant, Mount Union Refractories Company (purchased by National Refractories Company [NARCO] in 1929) opened at Mount Union. This was the first brick concern to receive its ganister from the EBT. Quarries located on Jack's Mountain above Three Springs delivered ganister via a 2600 foot

¹³⁰ Moore and Taylor, p.17.

¹³¹Krause, Corrine Azen. <u>The Hidden Industry: A History of Refractories in the United States, 1860-1985</u>. American Ceramic Society, 1987, p.42.

¹³² Moore & Taylor, p.16.

¹³³Wallace, p.97-98.

¹³⁴Rainey, p.75.

inclined plane railway. The NARCO plant was served by dual-gauge trackage, and EBT hopper cars unloaded directly at the plant track scale with no transhipment to standard-gauge cars. This business added "perhaps 140 tons of coal and some hundreds of tons of ganister" to the EBT's revenue hauls. The EBT served the NARCO quarry until the end of service in 1956. With the obvious exception of the coal mines, the NARCO quarry was the largest single source of traffic for the East Broad Top in its last decade. The served to the coal mines, the NARCO quarry was the largest single source of traffic for the East Broad Top in its last decade. The served traffic for the East Broad Top in its last decade.

The EBT also served several short-lived refractory-related operations. Between 1918 and 1927, white fire clay was quarried near Shirleysburg by U.S. Refractories for the manufacture of high temperature cement. 137 This required the construction of the "clay spur," now part of the wye used to turn excursion trains at Colgate Grove. In 1915, General Refractories (GREFCO) bought the MUSB and developed a new ganister quarry at Stanton. The East Broad Top extended the Shade Gap Branch from Neelyton to Stanton in 1919 to reach this facility. Like ganister delivery to NARCO, GREFCO deliveries were made on dual-gauge trackage. Ganister traffic from the Stanton quarry was short-lived, and shut down in 1927. GREFCO continued to make silica brick in Mount Union, although it did not obtain its ganister from an on-line EBT source. GREFCO continued to purchase Rockhill coal until the plant closed in 1953.

The simultaneous decline of the EBT's iron-related traffic and the rise of the Mount Union refractory brick industry, with its heavy tonnages of ganister and Rockhill coal, was fortuitous. When all three refractories were operating, the EBT delivered 520 tons of Rockhill coal per day to Mount Union, and between 600 and 900 tons of ganister to NARCO. This reversal of fortune, as well as the 1925 coal preparation plant, are the two factors most responsible for the longevity and success of the East Broad Top during the first half of the twentieth century. Unfortunately, further changes in the economics and utilization of minerals were ultimately responsible for the demise of the EBT.

¹³⁵Rainey, p.87.

¹³⁶Gale, William F. "Notes on the Operation of the East Broad Top Railroad and Coal Co. from 1946 to 1956." Interstate Commerce Commission, nd. p.3.

¹³⁷Moore & Taylor, p.50.

¹³⁸Rainey, p.127.

In 1954, the NARCO plant's brick kilns were converted from coal to oil, making Harbison-Walker the last refractory customer on the EBT. H-W converted from coal to natural gas in February of 1955, and the EBT was left with no customers for the coal sitting in its yards. What had been an ideal situation for the railroad, practically captive customers at their terminus with a healthy appetite for Rockhill coal, proved to be a tenuous position economically when a cheaper, cleaner fuel became available.

In the EBT's 1873 corporate minutes, the traffic base of the railroad is discussed and, with the exception of some iron ore traffic, the board concluded that "Otherwise, the railroad would haul coal with little local trade. "139 The corporate request for abandonment eighty-two years later echoes this knowledge: "Other than coal and rock traffic, there are no other industries of any importance along the line of this railroad. "140 Ultimately, reliance on limited commodities for its revenue, and not the failure of its steam operations or specific technology, put the EBT out of business. General Electric approached the EBT in 1953 and 1955 with studies for the replacement of the railroad's steam engines with light diesel engines. The cost of the new diesel engines compared to the railroad's operating revenues made the purchase impractical, and the performance of the equipment developed by the EBT handled traffic capably and efficiently. The acquisition of diesels would have significantly lowered motive power operation costs, but the future traffic situation did not justify the purchase.

The EBT began to plan for abandonment during the summer of 1955. On November 18, 1955, the railroad applied to the Interstate Commerce Commission to abandon the line. The abandonment application enumerates the declining coal orders from the refractories and clearly explains the simple choice to abandon the line: "The chief source of revenue of this company is its coal traffic, substantially all of which is derived from one principal shipper." This shipper was the Rockhill Coal Company, which planned to discontinue coal shipments on March 31, 1956. According to the EBT, the refractories "formed the most profitable segment of our traffic...," and "The loss of this coal traffic has cut nearly a quarter of a million dollars per annum off of our revenue, and is one of the chief causes of the

¹³⁹Hart, EBT Minutes (13 Jan. 1873), p.2.

¹⁴⁰Gale, "Notes on Operation," p.16.

difficulties confronting this railroad today."141

Rather than being abandoned, the EBT received a reprieve. On May 1, 1956, the entire holdings of the Rockhill Coal Company, the final incarnation of the RICCo., were sold to the Kovalchick Salvage Company of Indiana, Pennsylvania. Kovalchick reopened three and one-half miles of the line north of Rockhill Furnace for passenger excursions in 1961, and the operation continues to haul tourists during the summer months, using one of the four operable steam engines and the ancient wooden coaches. Today the entire main line of the EBT remains intact. At the northern end of the line, the Mount Union yards are heavily overgrown and mostly obliterated. An engine house and rows of decaying hopper cars stand as the only obvious signs of the former facility. At the southern end of the line, the company towns of Robertsdale and Woodvale retain their general appearance, and several company structures survive in various conditions. The focal point and best-preserved feature of the EBT stands between the two ends: the EBT Shop Complex and Station at Rockhill Furnace. This site is generally considered the best preserved steam-era shop complex in the United States.

SHOP COMPLEX

The nerve center of the East Broad Top Railroad was the Rockhill Furnace shop complex, where the day-to-day administrative affairs of the railroad were conducted and the locomotives, rolling stock, and physical plant were maintained and repaired. Railroads are often classified as industries because they resemble them in structure and operations. But railroads do not manufacture anything; instead they provide transportation and, more relevant to this discussion, service themselves. The East Broad Top shops, with an elaborate steampowered, belt-driven machine shop and a well-equipped foundry and blacksmith shop, made the railroad almost completely selfsufficient for castings, forgings, machining, and all wood and metal working. The EBT service structures are typical of the types of workshops found in small turn-of-the-century steam railroad shop complexes, but are unusual in their degree of preservation. This discussion is essentially limited to the HAER-

¹⁴¹Interstate Commerce Commission, "Application of the East Broad Top Railroad and Coal Company for a certificate of public convenience and necessity permitting the abandonment of all its railroad including return to questionnaire (or Application and Return to Questionnaire). (Interstate Commerce Commission, Washington, D.C. November 8, 1955), "The chief source...", p.2; "...refractories..."; "The loss...", p.15.

documented structures -- the roundhouse and turntable, blacksmith shop, machine shop, and foundry.

The greatest influence on the evolution of any railroad shop plan is the orientation of the incoming main line tracks, which in the case of the EBT, is roughly a north-south orientation. In typical fashion, primary rolling stock service and shelter structures such as the locomotive shop, car shop, and paint shop all share a parallel orientation with the main and yard tracks, as the easiest access to such structures was via a parallel track reached by a switch. Additions to these structures naturally followed parallel or perpendicular orientations, as did infill structures. The roundhouse, by virtue of its curved shape, does not appear to fit in to the rectilinear scheme; but the main track from the turntable leads directly south to the coaling, sanding and watering facilities, conveniently located directly on the main line at the south throat of the yard.

In 1872, the East Broad Top Railroad and Coal Company purchased the T.E. Orbison farm as the site for their shop complex. The farm was the only large flat piece of land in what was originally called Cromwell before the construction of the Rockhill furnaces. The shops grew around the 1867 stone farmhouse, which was retained for use as the first EBT office building. This structure became a storage building and shops office after the construction of the Orbisonia (Rockhill Furnace) depot and EBT Railroad office building in 1906. Subsequent storage additions now extend from the south wall.

The most prominent structure at the EBT shops, and certainly the most characteristic of railroad shops in general, is the engine house. The contract for the construction of the first EBT engine house was let on April 4, 1874, and the structure was completed on September 13 of the same year. The first EBT engine house was a wooden structure with four stalls and a slate roof, built to accommodate the small Baldwin 2-6-0 and 2-8-0 type engines weighing fifteen to twenty-six tons. 143

In 1882, the EBT replaced the four stall engine house with a

¹⁴²Grenard and Kramer, p.4.

¹⁴³Minutes of the Board of Directors of the East Broad Top Railroad and Coal Company, as transcribed by George M. Hart, in the collection of the Railroad Museum of Pennsylvania at Strasburg, p.3.; Rainey location chart.

six stall brick roundhouse. 144 The new structure had archways with hinged wooden doors, later replaced with the metal roll doors still in place today. The roof ridge was crested with a single curved monolithic monitor, and small metal stacks served as smokejacks. 145 The weight of EBT locomotives at this time was approaching thirty-eight tons, and in order to accommodate the longer engines the new roundhouse measured approximately 56 feet deep from the arched locomotive doorway to the far interior wall.

During the modernizations that took place during the Seibert administration, EBT motive power purchases became heavier and heavier, rising to seventy-five tons. In June 1915, the EBT proposed and shortly thereafter undertook an extensive remodeling of the roundhouse. Using bricks from the nearby defunct iron furnaces, two more locomotive bays were added to the west side of the building. A new roof with individual ventilation monitors, and larger smokejacks were added, and the entire north wall was moved out twelve feet, making all the locomotive bays sixty-eight feet long. An entirely new floor, with sixty-two feet long inspection pits, was also constructed to accommodate the EBT's final three motive power purchases, the first of which arrived in June of 1916. These engines weighed eighty-two tons each and almost completely filled their bays.

The new brick roundhouse served as far more than a shelter for the locomotives. In the roundhouse, engines were inspected, cleaned, and lubricated between runs, and light running repairs were performed. These repairs were typically minor jobs required to keep the engines running on a day-to-day basis. Two of the under-locomotive inspection pits were equipped with drop pits, devices that enabled repairmen to detach, lower, and lift out small locomotive and tender idler wheels. This was one of the most demanding tasks performed in the roundhouse; if longer, more involved repairs were necessary, the engines were brought to a separate facility attached to the Machine Shop.

The 1870s Shop Complex at Rockhill Furnace was apparently not an adequate locomotive repair facility. On April 15, 1878, the EBT Board of Directors reported "as it has proved expensive

¹⁴⁴ Date from Interstate Commerce Commission Valuation Reports--Engineering Report upon East Broad Top Railroad and Coal Company--Inventory, June 30, 1917. p.23.

¹⁴⁵For a good discussion of the evolution of the EBT shops through Sanborn fire insurance maps, see Reginald Arford's "Early East Broad Top: Tracing the Orbisonia Shops 1894-1911," <u>Timber Transfer</u>, vol.6, no.4, Winter 1990.

and otherwise unsatisfactory to send down our locomotives to Baldwins [sic] for repairs, we have obtained the consent of the Pennsylvania Railroad to do such work at Altoona." By the Summer of 1881, the East Broad Top was purchasing tools for a new machine shop, then under construction. The T-shaped core structure of the wood frame, board-and-batten sided machine shop, powered by a single boiler, was apparently finished in November or December of 1881, and included an engine repair area that gave the EBT greater heavy repair capability. In 1882, the EBT Board of Directors noted "We can repair engines in two or three days—heretofore a month to six weeks."

During the Seibert era, the Machine Shop and its attached departments were greatly expanded. The main shop floor in the Machine Shop was roughly doubled in length, indicating the purchase of new machinery. The patent dates on many of the machines in the Machine Shop and elsewhere indeed suggest a major capital investment in new machinery just after the turn of the century. 148 The former Carpenter's Shop was lengthened, and its name changed to the Car Shop. This shop contains woodworking machinery and three tracks for the erection of rolling stock. A wing parallel to the machine wing was built to accommodate a sheet metal shop, complete with shears, punches, rolls, brakes, benders, and welding equipment. The installation of this equipment later facilitated the construction of the EBT's allsteel hopper car fleet. Two 100 horsepower Babcock and Wilcox boilers were installed in this period, connected to a steam engine alleged to have come from the Rockhill Iron and Coal Co. plant. 149 The steam engine is connected to a remarkable belt driven lineshaft system of nearly three dozen separate shafts that drive machinery in the Machine Shop complex as well as the

¹⁴⁶Board of Directors, p.4. Additional references to this problem, include ""Other than locomotives, all repairs to rolling stock have been done at Rockhill," 1-13-1897,p.4, and the ambiguous "It is doubtful at this time we could get repairs done at all in any locomotive shop in the country." 11-15-1881, p.5.

¹⁴⁷Arford, Reginald. "Early Rolling Stock of the East Broad Top R.R.-Part II," <u>Timber Transfer</u>", Vol. 10, no.3, Winter 1994, p.13. Also see Board of Directors, 7-19-1881, 11-15-1881. Sanborn fire insurance map co., Rockhill Furnace, Pa., 1894.

¹⁴⁸Unfortunately, lack of access to corporate records makes the reconstruction of the EBT's purchasing plans for this era impossible.

¹⁴⁹Conversation with Stanley Hall, Sup't. EBT, 6-16-94.

adjacent Blacksmith's Shop and Foundry.

The engine repair area was renamed the Locomotive Shop and lengthened to accommodate larger engines. The Locomotive Shop contains two tracks and large drop pits capable of handling locomotive driving wheels. Immediately in front of the engine tracks is the locomotive wheel turning lathe (the shop's largest boring machine and lathe) an axle lathe, and a wheel press. The largest machines associated with the heaviest locomotive maintenance tasks were conveniently located closest to the locomotive tracks.

The blacksmith shop, also of wood frame construction with board-and-batten siding, was built prior to 1881. This facility was an important primary metalworking shop, equipped for very general or highly specific metal bending, flattening and reshaping processes. For general metalworking, the shop was equipped with three coal-fired smithing forges, a belt-driven saw and forging hammer, and a massive heavy steam forging hammer. The two most obvious specific processes which took place there were the repair and tempering of locomotive spring clusters, and the swedging of locomotive boiler tubes using a specialized forge and pneumatic hammer.

On September 15, 1885, the EBT Board of Directors "Agreed to erect a foundry at Rockhill." The foundry was also of wood frame construction with board-and-batten siding. Foundry work at the EBT followed typical practices of the day, using a shop-built coke-fired iron melting cupola driven by a twenty-four inch blower and a natural-draft brass melting crucible furnace for non-ferrous castings and locomotive brasses.

During the Seibert era, the foundry was greatly expanded. A pattern shop was built to the north of the coal-fired cross-draft core oven. A major addition was made to the south end in the form of a two-story raw materials charging deck with a pneumatic crane and storage bins on the second floor, and a casting flashing removal tumbler and iron scrap bin on the first. One of the oldest pieces of original equipment at the EBT shop site is the 1878 wooden-frame Perrottet & Hoyt foundry crane.

Construction of a foundry was a major step toward self-sufficiency. In fact, many surrounding customers became dependent on the EBT foundry for gray iron castings. The foundry naturally supplied castings to the Rockhill Iron and Coal Co. mines, and foundry patterns also exist for outside customers, such as a

¹⁵⁰Board of Directors, 9-15-1885.

pulley pattern for the Pennsylvania Glass Sand Company in Mapleton, Pa., near Mount Union, and a simple farmer's plow blade. 151

Great increases in locomotive power, and therefore size, made in standard-gauge railroading during the interwar years necessitated the wholesale reconstruction of many railroad shops, typically using materials such as cast concrete and glass brick. 152 Due to the EBT's financial position, and the comparatively small stature of their locomotives, the Railroad never modernized its first generation shop structures. The EBT shop forces continued to use the facilities that they knew and that functioned efficiently for them. The construction of an erecting shop to facilitate heavy locomotive maintenance was not necessary for so small a railroad. The shops were never significantly rebuilt during their history. Instead, modifications were ultimately incremental responses to changing technology, such as the purchase of larger locomotives or retooling for hopper car construction. This pattern of site development resulted in an unusual, intact first-generation steam railroad shop complex.

The clearest example of the replacement of equipment in the face of increasing physical demands is found in the succession of turntables at the Rockhill Shops. The turntable is a simple mechanism for changing the direction of a locomotive using a rotating beam with rails mounted on it. It is the very nature of a turntable's motion that makes the roundhouse round, and it should be considered an integral part of the EBT roundhouse, which also grew in response to larger motive power.

Little solid information about the first turntable at Rockhill Furnace exists beyond the original authorization for its construction in 1873. 153 By 1899, increases in locomotive size

¹⁵¹ Tagged patterns found on patternmaker's bench in foundry.

¹⁵²Howson, Elmer T., Ed. <u>Railway Engineering and Maintenance</u> <u>Encyclopedia</u>. Chicago: Simmons-Boardman, 1942. "Locomotive and Car Shops," p.679.

¹⁵³Board of Directors, 4-8-1873. Other evidence for the existence of an early turntable at Rockhill Furnace presented by Rich Keller in "Enigmas of the EBT II: EBT Turntables," <u>Timber Transfer</u>, vol. 7, no.1, Spring 1990, p.8-9, 23, includes a photograph of a locomotive on a turntable in an unidentifiable location, and the statement that the enginehouse "had" to have a turntable to accomplish a task which could actually have been done

caught up with what appears to have been the original turntable: "...the turntable was replaced only after it actually collapsed under the 64 1/2 tons of the new No.5 and its tender, even though management had known for years it was unsafe for heavier motive power." The make and diameter of the first turntable is unknown, but its replacement appears to have been a fifty-foot installation built by William Sellers of Philadelphia. The length of this turntable was apparently consistent with the depth of the roundhouse stalls prior to the 1915 expansion, and soon became insufficient for the new heavier locomotives, necessitating the installation of a third turntable.

The third turntable measures sixty-five feet long, fifteen feet longer than its immediate predecessor. 156 The new turntable was allegedly bought used from the New York Central Railroad, and modified for use on the EBT. 157 Turntables of the size common to nineteenth century railroads, and also to narrow-gauge railroads, were small enough to be turned by hand. These so-called "Armstrong" balanced turntables rotated on a central pivot, with non-load bearing idler wheels at the outside ends of the table. As locomotives grew heavier and longer, motorized, end-bearing units became necessary to turn engines, and balanced turntables became obsolete: railroads such as the New York Central then scrapped the older, obsolete turntables. Rather than purchase a new turntable the EBT apparently chose a less expensive route, acquiring a used unit that met its requirements. The EBT's third turntable actually employed both the "Armstrong" approach to rotation as well as a motorized traction truck that generated about a dozen horsepower, and could be operated by attaching it to the locomotive's air compressor with a hose.

with a wye and a set of switches. It is likely that an early turntable existed in this location, but the evidence is scant.

¹⁵⁴ Rainey, p.62.

 $^{^{155}}$ Compare the photograph of the "new steel" turntable on p.63 of Rainey with diagram, p. 11 of <u>Wm. Sellers & Co. Turntables</u>. The second turntable shares the same design using circular holes in the side members. This turntable was available in a fifty foot configuration.

¹⁵⁶Field measurements and June 1915 drawing of new and old turntable pits by EBT Engineer F.M. Butler, courtesy of Friends of East Broad Top.

¹⁵⁷Conversation with Stan Hall, same date.

The East Broad Top Railroad expended capital and physical changes in response to changing technology and markets. With the exception of the broad Seibert-era modernizations, this was never done on a large scale, but in response to specific problems, such as the timber transfer. Modernization always addressed specific problems, and outdated but serviceable equipment was retained if it was not critical to efficient operations. One example of this approach is the EBT's rejection of a Pennsylvania Central Light & Power Company proposal to electrify the EBT Shops, which would have replaced the lineshaft system with electric motors. 158 Another example is the track and switches in the Rockhill Furnace yard. During the Seibert era, the forty- and fifty-pound main line rail was replaced with rail weighing eighty-five pounds to the yard. In the shops, however, lengths of original Lackawanna forty-pound rail can still be found. Several now-unusual two- and three-way stub-end switches are still in service. A 1909 edition of Railway Track and Track Work said of stub-end switches, "...now rarely used in the United States...this form of switch is neither safe, efficient, nor economical...[they cause]...severe wear to wheels and switch... "159 These switches, which use a flush, perpendicular moveable joint rather than the tapered point-type modern switch, were also hard to maintain and prone to derailments. According to the critic, they were only good for light or infrequent use, as were the Lorenz "automatic" dual position trailing point slip-switches, noted as "now little used" by the same 1909 article but still found at the Rockhill Yards. Rather than replace the yard trackage and install new switches, the EBT retained the antiquated switches that suited the weight and frequency of their yard movements. The distinctive red and white "Harp stand" switch alignment indicators stand today as a symbol of the railroad's frugality.

CONCLUSION

The East Broad Top Railroad is in some ways a technological contradiction. Although a product of the largely ill-fated narrow-gauge movement, it fit almost every criteria for survival of narrow-gauge roads. Those factors that made it an exception to the rule also made it a candidate for survival where other narrow-gauge roads failed. The Railroad was built to a track gauge that saddled it with inherent transfer and volume

¹⁵⁸ A Proposal for Use of Central Station Power in the Orbisonia Shops of the EBT. In <u>Timber Transfer</u> v.5, no.1, Spring 1988. Unfortunately, the original is undated.

¹⁵⁹Tratman, E.E. Russel Railway Track and Track Work New York: McGraw Hill, 1909, p.110-111.

impediments. Rather than convert to broad-gauge, a modification beyond the capital resources of the EBT, the railroad made its own incremental compensatory technological changes to stay competitive. The EBT did take cues from the standard-gauge roads, purchasing larger engines, toughening tracks, and developing bridges and physical plant to modern, almost standard-gauge specifications. The in-house construction of the high-volume hopper car fleet was a contemporary solution to a narrow-gauge handicap. The use of the timber transfer harked back to the transfer devices of the 1880s which the EBT had considered but not adopted.

The East Broad Top Railroad is the ultimate expression of narrow-gauge railroading in America, retaining the three-foot gauge while utilizing standard-gauge, home-built, or appropriate technologies and approaches to the challenges it faced. The EBT did not go out of business because its narrow-gauge technology finally failed, but because its traffic base disappeared.

The Rockhill Furnace Shop Complex is the largest, most obvious and intact artifact of the East Broad Top Railroad. The Shop Complex is remarkable for several reasons. It is an unusual, even unique example of a first-generation steam-powered mining railroad shop complex from the last quarter of the last century, that escaped the wave of modernizations that transformed many railroad shop complexes in the early twentieth century. The EBT Shops also reveal the evolution of industrial facility in a remote location to permit the railroad almost complete selfsufficiency in maintenance and repair of its locomotives and rolling stock by providing it with blacksmithing, casting, and machining capabilities. More importantly, as a narrow-gauge railroad, the East Broad Top often had to develop and manufacture its own equipment, from obscure castings to railroad cars. The Rockhill Furnace Shops included the facilities to construct its own narrow-gauge rolling stock, most notably the high-capacity steel hopper car fleet which helped maximize coal loadings for the railroad.

The EBT Shop Complex is also remarkable simply for its survival, given the unused wooden buildings, accumulation of shop lubricants, and the continued presence of operating steam locomotives. The statement is often made that the EBT shops are as they were in 1956, when the workers walked away from their work stations for the last time. This is not entirely true, as key equipment and buildings have seen occasional or even continued use since the Railroad ceased operations. As far as the contents of the Shop buildings are concerned, however, they are essentially in their original state. With a few concessions to the modern steam excursion operation, the East Broad Top Shop

Complex is essentially a time capsule of 1920s era steam railroading.

Time and winter snows, combined with a lack of preventive maintenance, continue to take their toll on the Shop structures. The roof of the Machine Shop has been elaborately shored up, repairs have been made to the Roundhouse roof, and the Blacksmith Shop continues to lean dramatically to the east. This situation will continue to worsen without significant stabilization efforts.

The East Broad Top Railroad Shop Complex, and the other Railroad artifacts and features that stretch roughly thirty-two miles from Mount Union to Robertsdale, are all surviving components in a linear transportation story that ultimately includes regional and economic geology, coal mining, all three phases of Pennsylvania's iron and steel industry, canal and rail transportation, early land development, company town life, and other important aspects of Pennsylvania's and our national industrial heritage. The entire story could be told here. The East Broad Top Railroad is a web that draws all of these elements together, and the Rockhill Furnace Shop Complex is at the center of that web.

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This narrative concentrates on the economic geology and narrow gauge technology of the East Broad Top Railroad, and the choice of sources consulted reflects this direction. Much of the material specific to the geology of the Broad Top was found at the Pennsylvania Geological Survey library at Harrisburg and at the Earth Sciences Library at State College. Information on Huntingdon County history, including industry and transportation, was found at the Huntingdon County Historical Society in Huntingdon, and at the State Library at Harrisburg.

Information on the EBT itself came from a variety of sources, including the railroad itself. Mr. Stanley Hall Sr., Superintendent of the EBT, deserves particular credit for providing assistance and technical information that could not have been found elsewhere. Unfortunately, Kovalchick Salvage Company, owners of the EBT, were unwilling to change their long-standing policy forbidding access to a large body of EBT corporate and operational papers which are stored at the EBT offices in Rockhill Furnace. The extent of these records is unclear; however, it is likely that they would have been of some value to this narrative. The complete history of the East Broad Top Railroad may not be known until this material is made available to the public.

A significant source of information came from within the rail enthusiast fraternity. The Friends of the East Broad Top, an unaffiliated EBT enthusiasts' organization provided a full run of back issues of their newsletter, the <u>Timber Transfer</u>, which contains many useful technical and historical articles.

Only a handful of book-length treatments of the EBT's history have been published, and with one exception, they are not especially thorough in their treatment of the subject. Lee Rainey and Frank Kyper's East Broad Top, however, is an exhaustive treatment of the subject, and it appears that primary author Rainey made an extensive archival search to assemble the large list of sources given in the appendix. Although researched in a scholarly manner, the book unfortunately does not contain footnotes, which makes following Rainey's historiographical trail difficult. Dr. Rainey kindly supplied a fully-annotated copy of the East Broad Top manuscript, which was of great assistance in identifying fruitful avenues of research.

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ADDENDUM TO
EAST BROAD TOP RAILROAD & COAL CO.
Pennsylvania State Route 994,
West of Route 522
Rockhill Furnace
Huntingdon County
Pennsylvania

HAER No. PA-127

HAER PA 31-ROCFN 1-

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